JANUARY, 1942

ELECTRICAL SOUTH

621.305
E38

FANS by HUNTER-CENTURY

55th SEASON

52-In. Hotel Type

24-In. "Airspread" Ceiling Safety Type

IN its 55th year of continuous operation, HUNTER will concentrate in producing a supply of fans adaptable for war defense requirements and industrial usage. • The same high quality of workmanship and materials will be found in HUNTER products and the regular guarantees of excellent performance and long life. • HUNTER distributors and dealers will carry representative stocks throughout the United States.

12-In. Osc.

HUNTER FAN & VENTILATING CO., INC.

Factory: FULTON, N. Y.
General Sales Offices: Memphis, Sterick Bldg.
Eastern Sales Office: New York, 92 Warren St.
Western Sales Office: St. Louis, 1804 Pine St.

Sales Offices:
ATLANTA CHICAGO DALLAS HOUSTON LOS ANGELES
PHILADELPHIA BOSTON CLEVELAND DETROIT
KANSAS CITY NEW ORLEANS PITTSBURGH ST. LOUIS

24-In. "Airspread" Adjustable Pedestal Type

Zephair Comfort Cooling Attic and Commercial Ventilators

16-In. Osc. Capacitor Motor

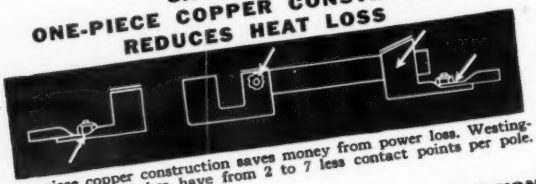
protect PRODUCTION CIRCUITS WITH WESTINGHOUSE SAFETY SWITCHES

SAVE MAINTENANCE
EXCLUSIVE DIAMOND-POINTED BREAK JAW KEEPS ARCING OUTSIDE CONTACT AREA

The ordinary way. Arc travels across switch jaw.

The Westinghouse way. Arc outside contact area.

SAVE POWER
ONE-PIECE COPPER CONSTRUCTION REDUCES HEAT LOSS



One-piece copper construction saves money from power loss. Westinghouse safety switches have from 2 to 7 less contact points per pole.

THESE FEATURES MEAN EASIER INSTALLATION —LOWER MAINTENANCE

Concentric knock-outs, top, bottom and both sides • Solderless lugs • Reinforced fuse clips assure maximum fuse contact and reduce heating. Warpproof, moistureproof Micarta crossbar • Steel parts cadmium-plated to resist rust and corrosion • Wearing parts of operating mechanism heat-treated for longer life • Door can be padlocked to prevent unauthorized operation • Switch operating mechanism inside handle on Type A leaves ample wiring space, prevents damage to conductor insulation • Non-carbonizing composition base • Quick-make, quick-break on Types A and C minimizes switch burning.

WESTINGHOUSE ELECTRIC & MFG. CO.
EAST PITTSBURGH, PA.

J-21147

Westinghouse offers a complete line of safety switches: Fusible and nonfusible; Types A and C for motor circuits and general use; Type D for general use; 30 to 1200 amperes; 125 to 600 volts.

Westinghouse

IDEAS YOU CAN USE...

TO SAVE VITAL MATERIALS TO GET WIRES AND CABLES FASTER

By using these practical wiring ideas whenever possible, your needs —and in turn our needs—for precious priority materials will be greatly reduced. Thus not only can we be more certain of filling your order, but also can often speed its delivery.

HAZARD PERFORMITE-12-RH-600V HEAT RESISTING

NEW WIRING

In place of Code wire, use HAZARD Performite—its extreme heat resistance means greater load capacity with the same amount of copper . . . or the same capacity with less copper. Precious copper . . . especially in the case of larger sized wires . . . is thereby conserved and smaller conduits requiring less steel can be used. Write for bulletin 118.

HAZARD WATERTITE--12--RW--600V---HAZARD

WET LOCATION WIRING

Use HAZARD Watertite, Type RW. Its submarine rubber insulation requires no lead sheath protection and saves this vital material. Full details are found in bulletin 168A.

UNDERGROUND INSTALLATIONS

Instead of cable with lead sheath and steel tape . . . or with rubber sheath . . . use HAZARD Armortite—the non-metallic underground cable with the outstanding record of no service failures. Armortite makes important savings of lead, steel and rubber. Send for bulletin 115 for complete facts.

HAZARD HAZAKROME---12--SN--600V--SYNTHETIC

REWIRING

Use HAZARD small diameter wires. They permit more or larger capacity wires to be installed in original conduit, eliminating the need for new conduit and thus save steel. Bulletin 200 gives all the facts.

All of these HAZARD Insulated Wires and Cables are fully approved under the N.E.C. All are carefully built to deliver the continuous, trouble-free operation you and your customers want.

INDIVIDUAL HELP

If you would like assistance in planning jobs these days, our experienced Engineering Department is ready to help anytime, without charge or obligation. From our Research Laboratories are coming many new ideas — one may be just the solution to a problem you have. These two departments are as much yours as ours. And there was never a better time for both of us to make use of them than during this emergency. Just write or telephone.

HAZARD INSULATED WIRE WORKS
DIVISION OF THE OKONITE COMPANY
Works: Wilkes-Barre, Pa.
Offices in principal cities

HAZARD
Insulated Wires and Cables

ELECTRICAL SOUTH is published monthly by W. R. C. Smith Publishing Co., Marietta, Ga., and Atlanta, Ga., U. S. A.
Subscription rates, United States and Possessions, $1.00 for one year; $2.00 for three years; Canada, $1.50 per year; Foreign Countries, $2.00 per year.
Entered as second class matter at the postoffice, Marietta, Ga., under Act of March 3, 1879.
Volume 22 Number 1

NEWS

About The New General Electric Refrigerators

As this advertisement is being written, the United States has just been attacked. What the future may bring, no one knows. One thing is certain. There will be fewer refrigerators produced during 1942—but the new G-E's are equal in all ways and better in many ways than any refrigerators General Electric ever built.

NEW lower operating cost! Basically unchanged, but constantly improved, the famous G-E sealed-in-steel Thrift Unit now uses less current than ever before.

NEW lower cabinet temperatures for better food conservation and better vitamin preservation.

NEW improved G-E Butter Conditioner keeps butter just right for easy spreading.

NEW diamond-hard gleaming white sanitary porcelain evaporator.

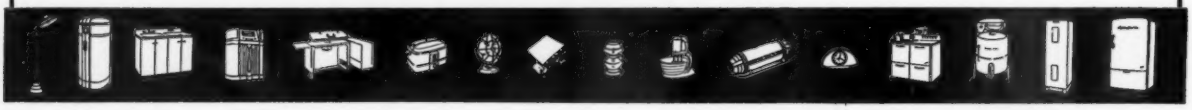
NEW tilt-type Dry Storage Bin with 14 per cent greater capacity than ever.

NEW improved compensated controls, **NEW** gray Textolite door strips, **NEW** de luxe styling inside and out—plus Conditioned Air, Selective Storage Zones and all other proved G-E features for greater convenience and economy.

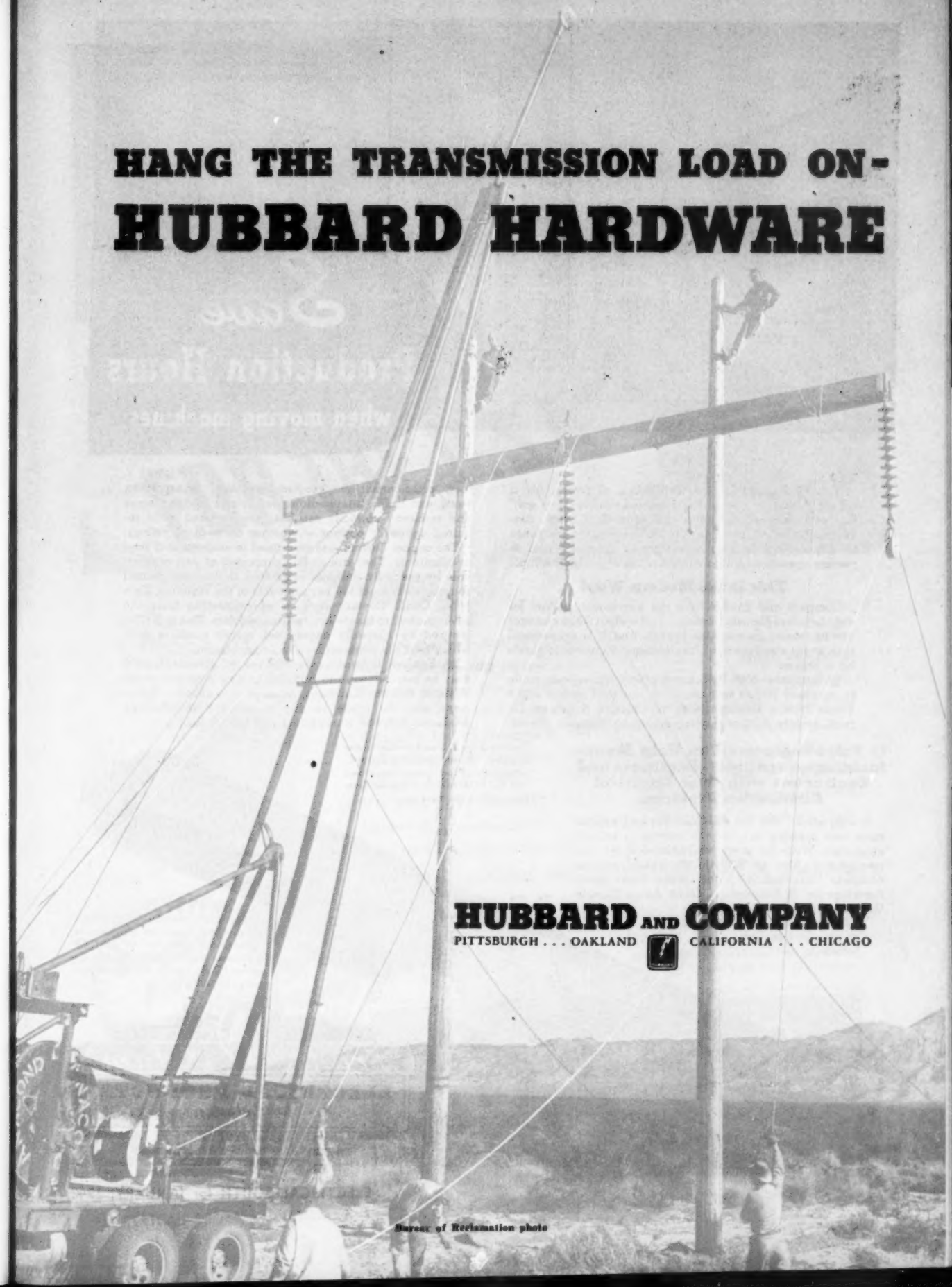
NEW simplified line of models with sound step-up selling features to attract every class of buyer.

AS ALWAYS, the finest and most complete line of electrical home appliances to draw upon for greater volume. You'll Always Be Glad You Sold General Electric!

GENERAL ELECTRIC

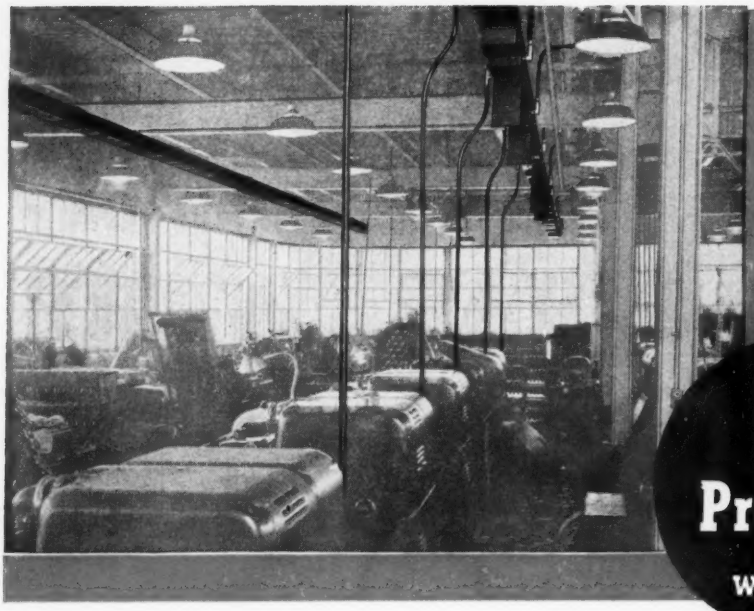


HANG THE TRANSMISSION LOAD ON-
HUBBARD HARDWARE



HUBBARD AND COMPANY
PITTSBURGH . . . OAKLAND CALIFORNIA . . . CHICAGO

Bureau of Reclamation photo



This (FA) Busduct installation in a Michigan defense project shows how simple it is to place the machines, to plug in, and to start operation without delay.

Save Production Hours when moving machines

With (FA) Busduct for the distribution of power, it's a simple matter to "move the machine — plug in — go!" The easily accessible outlets of Plug-in (FA) Busduct, conveniently spaced, make it possible to move the machines to any desired location — to plug in quickly — and to resume operations with a minimum loss of productive time.

This is the Modern Way!

Compact and flexible, it is the convenient method for distribution of Electric Service . . . It is ideal when changes are necessary in machine layout. And it is economical from every standpoint, as installations in numerous plants have proved.

(FA) Busduct—both feeder and plugin types—are made in standard 10-foot sections. Each standard section of the Plugin type is arranged with nine plug-in outlets on 12-inch centers. (Other spacing optional.) Suitable elbows, tees, cross-connections, expansion joints, transposition joints, end boxes, intermediate feed-in and feed-out boxes and reducing capacity sections, are supplied to fit required space or position — whether on wall or ceiling.

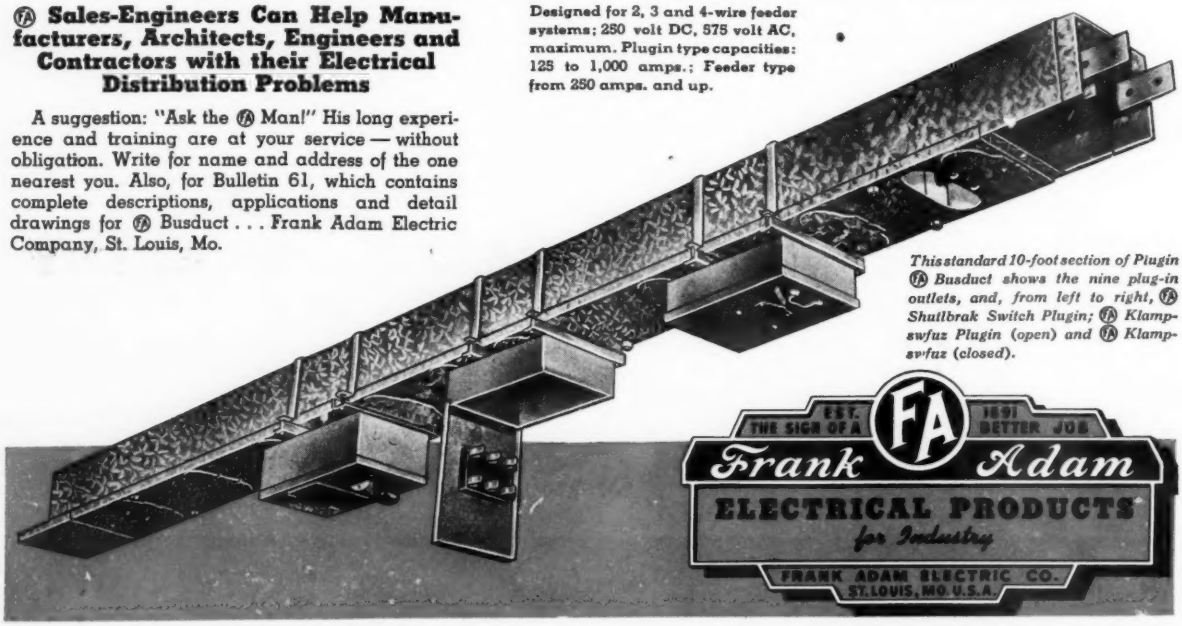
The copper busbars are contained in enclosures of steel or aluminum. They are rigidly supported at proper intervals by specially designed insulators that insure correct spacing — to meet the requirements of the National Electrical Code. Contact surfaces of connecting bars are silver-plated, to insure low resistance joints. This is further assured by specially engineered spring pressure bolts which hold the joints under even compression.

(FA) Busduct is practically immune to deterioration. It may be taken down and installed in new positions, in the same or different buildings, as need may require. Extensions may be made readily to existing installations. Moderate first cost is combined with low up-keep.

(FA) Sales-Engineers Can Help Manufacturers, Architects, Engineers and Contractors with their Electrical Distribution Problems

A suggestion: "Ask the (FA) Man!" His long experience and training are at your service — without obligation. Write for name and address of the one nearest you. Also, for Bulletin 61, which contains complete descriptions, applications and detail drawings for (FA) Busduct . . . Frank Adam Electric Company, St. Louis, Mo.

Designed for 2, 3 and 4-wire feeder systems; 250 volt DC, 575 volt AC, maximum. Plugin type capacities: 125 to 1,000 amps.; Feeder type from 250 amps. and up.



This standard 10-foot section of Plugin (FA) Busduct shows the nine plug-in outlets, and, from left to right, (FA) Shutlbrak Switch Plugin; (FA) Klamp-swfuz Plugin (open) and (FA) Klamp-swfuz (closed).

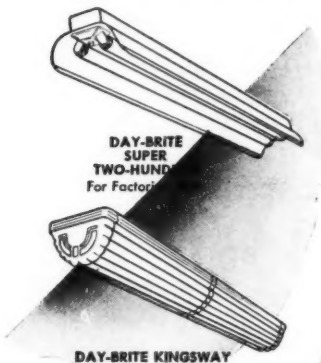
EST. 1891 — THE SIGN OF A BETTER JOB

Frank Adam

ELECTRICAL PRODUCTS for Industry

FRANK ADAM ELECTRIC CO. ST. LOUIS, MO. U.S.A.

A 24-HOUR DAY FOR THE U.S.A.



ON the front line of Victory, light makes right — 24 hours a day! Seeing better means doing better! And, that's where Day-Brite Fixtures help — they utilize the higher efficiency of fluorescent lighting . . . Backed by 18 years' specialized lighting experience, they are designed and engineered to lessen eye fatigue and assure the clearer vision necessary for greater accuracy, closer tolerances, quantity output and fewer rejects . . . DAY-BRITE IS THE LIGHT LINE OF VICTORY! . . . Consult Day-Brite Engineering Representatives, located in principal cities . . . Nationally distributed through all Leading Electrical Supply Houses.

DAY-BRITE LIGHTING, INC., 5432 Bulwer Ave., St. Louis, Mo.

Whatever you need in Fluorescent Fixtures is available in the Complete Day-Brite Line! A large, modern plant geared to high-speed, accurate, quantity production every step of the way. Send for catalogs.

DayBrite Rivals Daylight

Adds Defense Hours!

THE COMPLETE LINE OF FLUORESCENT LIGHTING FIXTURES

Day Brite FLUORESCENT FIXTURES

33

Partners in Defense

Production and use of steel are teamwork jobs. Neither one can exist without the other. Through forty-one years, Youngstown and its customers have been partners in helping America to build for progress and prosperity.

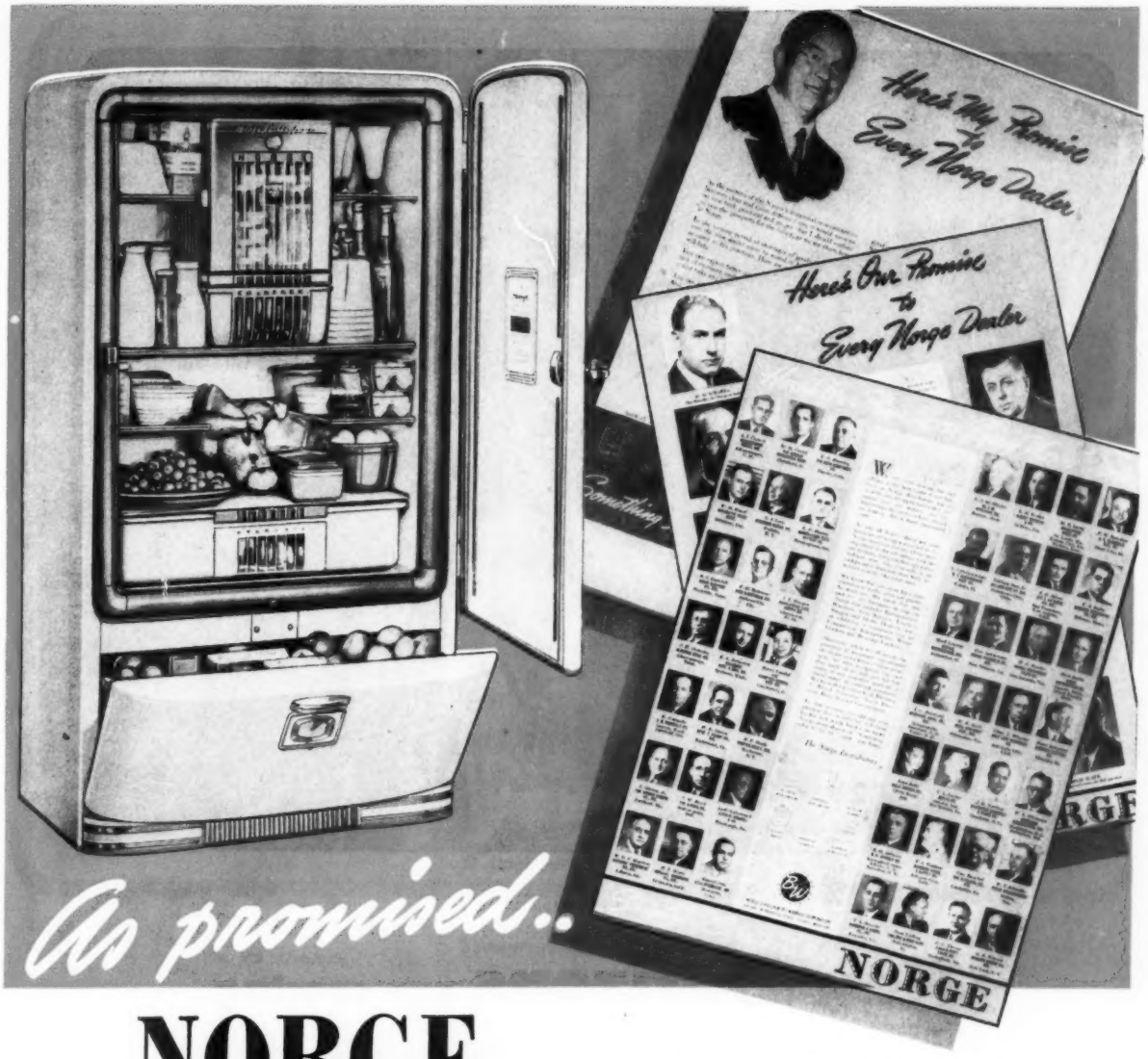
Now the emergency has interfered with our normal relationships. New demands impose burdens and restrictions on us all. But we believe you will see clearly with us that the solution of our problems, both national and individual, lies in mutual cooperation.

Let us remember that today you and we are partners in a new sense—partners for the protection of America.

THE YOUNGSTOWN SHEET AND TUBE COMPANY

YOUNGSTOWN, OHIO

25-30D



NORGE comes through for '42

SALE-MAKER FEATURES

*Famous Night-Watch Automatic Defrosting

New Base Leveller Adjusts to Uneven Floors

New Deeper Coldpack Never Used for Defrosting

New Deeper Hydrovoirs Fully Glass Covered

New Use of Plastics Lovelier Interiors

**Norge has all the other Big Features, too — but only Norge has the Night-Watch*

SEE **NORGE** BEFORE YOU BUY

In recent months Norge has published a series of advertisements promising to dealers every co-operation and consideration within its power. Swift to back up promise with performance, Norge now presents the new 1942 version of Norge Rollator Refrigeration.

Keyed to the market from the dealer's point of view, the new Norge line presents seven models that cover the demand—planned in a powerful and logical step-up sequence that fits the requirements of modern retail merchandising.

Keyed to the consumer's point of view, this new Norge line shows brilliant styling, consistently maintained quality, new convenience features, and all the ruggedness, dependability and economy for which Norge has long been noted. Make no mistake about it—*you can depend on Norge for '42.*

NORGE DIVISION · BORG-WARNER CORP. DETROIT

***Something Solid to tie to*—NORGE**

ROLLATOR REFRIGERATION • GAS RANGES • WASHERS
ELECTRIC RANGES • HOME HEATERS • COMMERCIAL REFRIGERATION

PRODUCT OF BORG-WARNER

New Horizons are coming into focus fast!

Anaconda quickens search for better wires and cables for American Industry and Defense

America is moving ahead at a faster pace. New industrial horizons are being reached and passed daily . . . thanks to the ingenuity of private research.

In the laboratories of the Anaconda Wire & Cable Company, for example, engineers are building longer life, greater current capacities, greater dependability in the power lines supplying electrical energy to vital defense machinery. But even when our defense goal is achieved, research will be looking further ahead . . .

Tomorrow when peace comes, Anaconda Wire & Cable Company will be ready with not only many new products, but also many product improvements for those who have been denied them during the emergency period. There will be better wires and cables available for a better and greater era of industrial progress.

ANACONDA WIRE & CABLE COMPANY
General Offices: 25 Broadway, New York City
Chicago Office: 20 North Wacker Drive
Subsidiary of Anaconda Copper Mining Company
Sales Offices in Principal Cities 41370

ANACONDA
from mine to consumer

This familiar trademark identifies Anaconda products. It symbolizes the best efforts of man and science.

ELECTRICAL WIRES AND CABLES OF COPPER ARE THE LIFE LINES OF OUR NATION

ANACONDA WIRE AND CABLE

JANUARY
1942

Volume 22 No. 1

ELECTRICAL SOUTH

J. C. MARTIN, Manager
RICHARD P. SMITH, Promotion Manager
W. E. COOGLER, Production Manager

Editorial and Business Offices
GRANT BUILDING
ATLANTA, GEORGIA

MEMBER OF A. B. P.
MEMBER OF A. B. C.

ANNUAL SUBSCRIPTION—$1.00
THREE YEARS—$2.00
CANADA—$1.50; FOREIGN—$2.00

Business Representatives:
L. E. ALLEN, 189 West Madison St., Chicago, Ill. Tel: Lakeview 10282.
L. R. MCCARTY, 325 Winding Way, Merion, Pa. Tel: Merion 1066.
W. A. MCGEE, P. O. Box 562, Charlotte, N. C. Tel: 3-4932.

Published Monthly by
W. R. C. SMITH
PUBLISHING CO.
Marietta and Atlanta, Ga.

W. J. ROOKE, *President*,
T. W. MCALLISTER, *Vice-President and Editorial Director*,
R. W. O'BRIEN, *Vice-President*,
R. W. PHILIP, *Vice-President*,
RICHARD P. SMITH, *Vice-President*,
O. A. SHARPLESS, *Treasurer*,
J. C. MARTIN, *Secretary*,
E. L. PHILPOT, *Asst. Secretary and Treasurer*.

Publishers Also of
COTTON
SOUTHERN HARDWARE
SOUTHERN AUTOMOTIVE JOURNAL
SOUTHERN POWER AND INDUSTRY

T. W. McALLISTER, Editorial Director CARL W. EVANS, Editor
NAT M. JOHNSON, Southwestern Editor

Contents

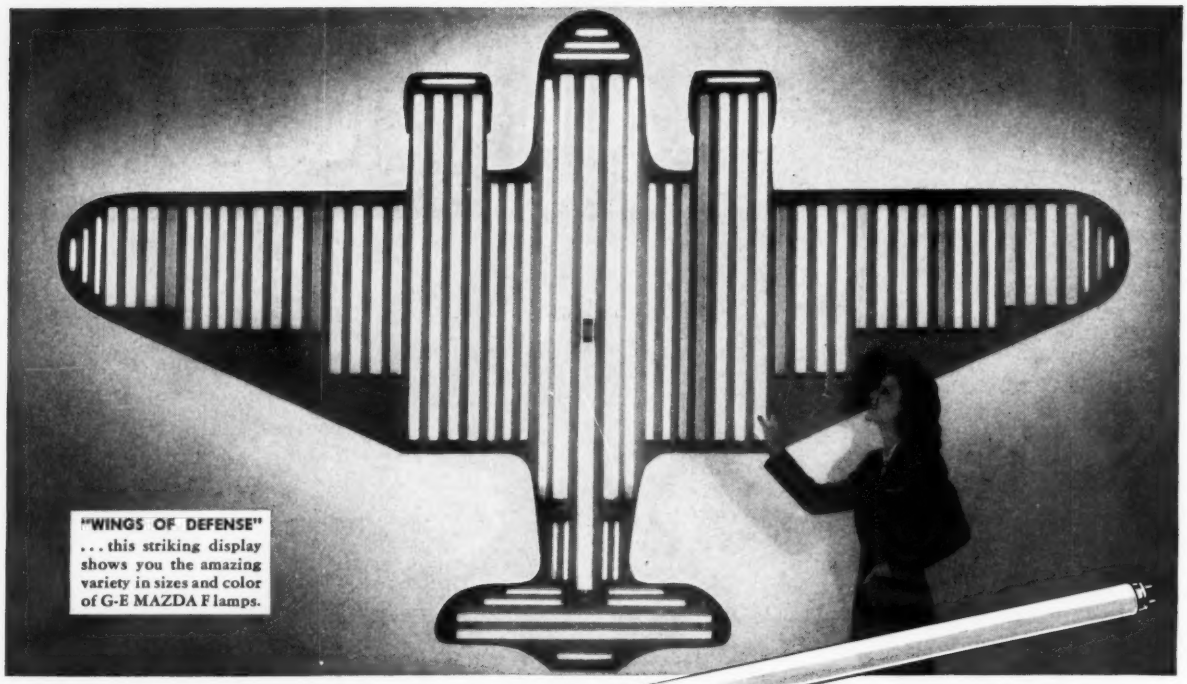
Industrial Lighting Simplified by "Seeing Task" Analysis	11
Industrial Wiring Practice—Part 1	15
Testing Routine for Motors	17
New Wiring Methods Utilized in Building Modernization	18
Defend Your Business with Better Management—Part 2	20
New Fluorescent Fixture Design Culminates 2-Year Research	22
Outlook for Appliance Dealers in 1942	24
Oklahomans Visit Reddy Kilowatt	27
Showmanship in Sales Promotion	28
Utility Conditions at Year End	30

Departments

Practical Helps for the Trade	37
Industrial Electrification	41
Electrical Distribution	45
News of the Industry	49
Personal Notes About Men You Know	60
New Equipment and Materials	62

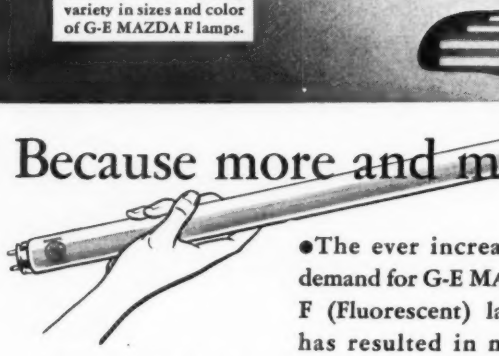
Copyrighted 1942, W. R. C. Smith Publishing Co., Atlanta, Ga.

Entered as second class matter at Marietta, Ga. U. S. A., under Act of March 3, 1879.



"WINGS OF DEFENSE" . . . this striking display shows you the amazing variety in sizes and color of G-E MAZDA F lamps.

Because more and more folks want these lamps



●The ever increasing demand for G-E MAZDA F (Fluorescent) lamps has resulted in many manufacturing economies in our fluorescent factories. In line with long established General Electric policy, these savings are passed along to our customers through the reduced prices on G-E MAZDA F lamps announced below, effective January 1, 1942.

This reduction marks another step in the downward trend of the cost of Better Light for Better Sight. (Since G-E MAZDA F lamps were first introduced in 1938 prices have been reduced as much as 60%). It is particularly significant now, since so many of these lamps are being used to supply cool, efficient "indoor daylight" for defense industries . . . to speed production, cut down waste and protect the eyesight of defense workers.

Effective January 1, 1942

NEW LOW PRICES ON G-E MAZDA F LAMPS

14-watt T-12	was	90c	NOW	80c
15-watt T-8	was	75c	NOW	65c
15-watt T-12	was	95c	NOW	80c
20-watt T-12	was	95c	NOW	80c
30-watt T-8	was	95c	NOW	80c
40-watt T-12	was	$1.35	NOW	$1.15
100-watt T-17	was	$3.00	NOW	$2.60

Above prices refer to daylight and 3500° white.
Prices also reduced on soft white and colored G-E MAZDA F lamps.

G-E MAZDA LAMPS

GENERAL ELECTRIC

ELECTRICAL SOUTH

JANUARY, 1942

INDUSTRIAL LIGHTING SIMPLIFIED BY "SEEING TASK" ANALYSIS

"All out" industrial production will require considerable lighting modernization. New tables aid selection of proper industrial illumination levels.

AS THE United States swings from its position as "Arsenal of Democracy" to an active belligerent in the war, our attitude toward industrial lighting changes in an important respect. Heretofore, the benefits of improved industrial lighting have been considered as benefits accruing to the employees and employers immediately concerned. Today, recognizing that "all-out" industrial production will determine the outcome of this conflict, we can go so far as to say that good industrial lighting will help preserve democracy.

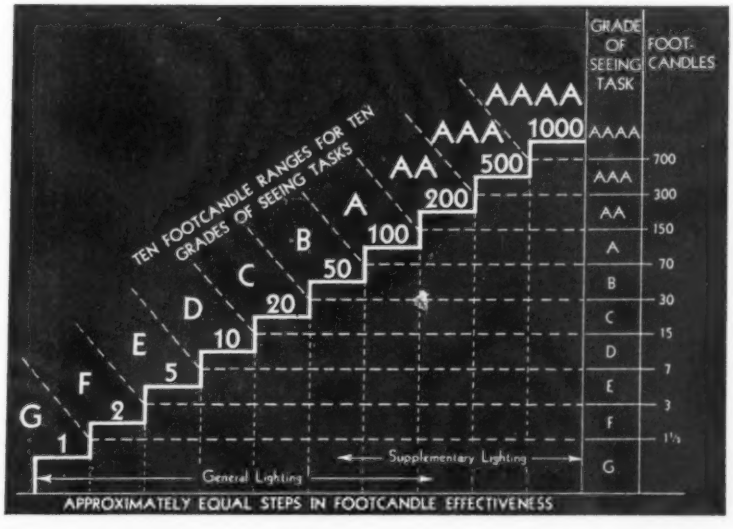
Despite the fact that scores of munition industries have already gone over to a 168-hour week which means continuous operation, there are hundreds of others that must be converted to this scale of operations and will require modernization of lighting equipment in making the change if production facilities are to be operated at maximum efficiency.

A recently completed survey of 394 war material plants showed that only a little more than half, 226, were employing three shifts. Of the remainder, 114 were working two shifts and 54 were operating with only one shift. Another interesting fact revealed by this survey is that only 25.8 per cent of the total number of employees were employed on other than day shifts—this being the result, in many instances, of inadequate lighting. That lighting in industrial plants has not kept pace with lighting developments in general is indicated by the fact that the value of industrial lighting equipment sold during the period 1933 to 1937 increased by only 39 per cent in comparison with an increase of 67.5 per cent in the value of all lighting equipment sold.

The design of industrial lighting installations will be aided materially by the table of recommended levels of illumination in industrial plants issued by the Better Light-Better Sight Bureau. Recommended levels of illumination for over 150 industries, with foot-candle intensities broken down for typical tasks, and illumination levels suggested for many other activities, have just been made available in an unusually concise, comprehensive form.

In addition to lighting intensities recommended for many types of industrial interiors, the new tables include recommendations for offices, drafting rooms, schools and public buildings; for merchandising, display, recreation and entertainment purposes; for building construction, storage and other outdoor areas.

These recommendations will be more satisfactory than any previously compiled, the Bureau be-



This step diagram, upon which the accompanying tables of illumination levels for industrial plants are based, illustrates the scientific fact that existing foot-candle levels should be at least doubled if measurable and significant improvements in seeing are to result.

lieves, because they are based primarily on careful studies of illumination increases needed to produce measurable increases in visibility, at various intensity levels. Figures given represent what should be prevailing practice. They are not minimum standards, but averages, and can be varied considerably in the upper levels, according to conditions met by lighting engineers on specific installations.

The accompanying tables are based upon the fundamental step diagram of equal foot-candle effectiveness, as shown in the diagram, which pictorially illustrates the scientific fact that existing foot-candle levels should be at least doubled if measurable and significant improvements in seeing are to result. In addition the new recommendations give full weight to the improvements in old light sources, the high efficiencies of the new, and the ever downward trend in lighting costs as a result of all these improvements. They reflect the growing public consciousness of the need for better lighting for Better Seeing, and they simplify the problem of satisfying this need by classification of all seeing activities into ten grades depending upon the severity of the visual task.

The grade classification accompanies every foot-candle recommendation, thereby establishing the fundamental basis for the values listed. Of course there can be some variation in seeing severity even within a grade, hence the single values appearing in the tables represent modern practice, while the range of values given in the descriptive footnotes accompanying the grades permit slightly lower or higher values depending upon the judgment of the lighting consultant.

This new feature of the table gives it flexibility and permits the user to exercise his judgment based upon familiarity with the lighting problem and the economic factors involved, without over-emphasis on minimum practice and without the restraint of a single value when higher levels than modern practice are justified because of the seeing requirements of the installation.

INDUSTRIAL INTERIORS

	Foot-candles	Grade
Assembly:		
Medium	20	C
Medium Fine	50	B
Fine	100	A
Extra Fine	200	AA
Automobile Manufacturing:		
Assembly Line	100	A
Frame Assembly	20	C
Body Manufacturing—		
Parts	20	C
Assembly	20	C
Finishing and Inspecting	200	AA
Bakeries	20	C
Book Binding:		
Folding, Assembling, Pasting, etc.	10	D
Cutting, Punching and Stitching	20	C
Embossing	20	C
Breweries:		
Brew House	5	E
Boiling, Keg Washing and Filling	10	D
Bottling	20	C
Candy Making:		
Box Department	20	C
Chocolate Department—		
Husking, Winnowing, Fat Extraction, Crushing and Refining, Feeding	10	D
Bean Cleaning and Sorting, Dipping, Packing, Wrapping	20	C
Milling	50	B
Cream Making—		
Mixing, Cooking and Molding	20	C
Gum Drops and Jellied Forms	20	C
Hand Decorating	50	B
Hard Candy—		
Mixing, Cooking and Molding	20	C
Die Cutting and Sorting	50	B
Kiss Making and Wrapping	50	B
Canning and Preserving	20	C
Chemical Works:		
Hand Furnaces, Boiling Tanks, Stationary Driers, Stationary and Cavity Crystallizers	5	E
Mechanical Furnaces, Generators and Stills, Mechanical Driers, Evaporators, Filtration, Mechanical Crystallizers, Bleaching	10	D
Tanks for Cooking, Extractors, Percolators, Nitrators, Electrolytic Cells	20	C
Clay Products and Cements:		
Grinding, Filter Presses, Kiln Rooms	5	E
Molding, Pressing, Cleaning and Trimming	10	D
Color, Glazing and Enameling	20	C
Cleaning and Pressing Industry:		
Checking and Sorting	20	C
Dry and Wet Cleaning and Steaming	10	D
Inspection and Spotting	200	AA
Pressing—		
Machine	20	C
Hand	50	C
Receiving and Shipping	10	D
Repair and Alteration	200	AA
Cloth Products:		
Cutting, Inspecting, Sewing—		
Light Goods	30	C+
Medium Goods	100	A
Dark Goods	200	AA
Pressing, Cloth Treating (Oil Cloth, etc.)—		
Light Goods	20	C
Medium Goods	50	B
Dark Goods	100	A
Coal Tipples and Cleaning Plants:		
Breaking, Screening and Cleaning	10	D
Picking	200	AA
Construction—Indoor		
General	10	D
Dairy Products	20	C
Elevators—Freight and Passenger	10	D
Engraving	200	AA
Forge Shops and Welding	10	D
Foundries:		
Changing Floor, Tumbling, Cleaning, Pouring and Shaking Out	5	E
Rough Molding and Core Making	10	D
Fine Molding and Core Making	20	C
Garages—Automobile:		
Storage	10	D
Repair Department and Washing	50	B
Glass Works:		
Mix and Furnace Rooms, Pressing and Lehr, Glass Blowing Machines	10	D
Grinding, Cutting Glass to Size, Silvering	30	C+
Fine Grinding, Polishing, Beveling, Etching and Decorating	50	B
Inspection	100	A
Glove Manufacturing:		
Pressing, Knitting, Sorting—		
Light Goods	20	C
Medium Goods	50	B
Dark Goods	100	A
Cutting, Stitching, Trimming and Inspecting—		
Light Goods	30	C+
Medium Goods	100	A
Dark Goods	200	AA
Hangars—Airplane	50	B
Hat Manufacturing:		
Dyeing, Stiffening, Braiding, Cleaning and Refining—		
Light	20	C
Medium	50	B
Dark	100	A
Forming, Sizing, Pouncing, Flanging, Finishing and Ironing—		
Light	20	C
Medium	50	B
Dark	100	A
Sewing—		
Light	30	C+
Medium	100	A
Dark	200	AA
Ice Making—Engine & Compressor Room	10	D
Inspection:		
Medium	20	C
Medium Fine	50	B
Fine	100	A
Extra Fine	200	AA

Grade Classifications

The various grade classifications and their applications are as follows:

Grade A — 100 foot-candles. For very exacting and prolonged seeing tasks such as fine bench and machine work, extra fine hand painting and finishing, and for the discrimination of fine detail of low contrast as in pressing dark cloth products and weaving dark woolens. For show-cases, wall cases and open counter displays in stores where discrimination of detail and attention value are important factors. (Under varying circumstances the foot-candles may range from 30% below to 40% above the value given.)

Grade B — 50 foot-candles. For severe and prolonged seeing tasks such as medium bench and machine work, medium fine assembly and inspection, fine sanding and finishing woodwork, drafting and proofreading. For general merchandising areas in stores and for show windows in small towns. (Range—minus 30% to plus 40%.)

Grade C — 20 foot-candles. For moderately critical and prolonged seeing tasks such as rough bench and machine work, medium assembly and inspection, hand painting and finishing, for pressing light cloth products and weaving light woolens. For circulation areas in stores. (Range—minus 30% to plus 40%.)

Grade D — 10 foot-candles. For visually controlled work in which seeing is important but more or less interrupted or casual, and does not involve discrimination of

fine details or low contrasts — for rough manufacturing processes such as molding clay products and cements, glass blowing machines, billet, blooming and sheet bar mills in steel manufacturing. For stock rooms and active storage areas for a variety of small articles such as for merchandise stocks.

Grade E — 5 foot-candles. For interiors where crude manual tasks are intermittently carried on, such as required for grinding clay products and cements, stone crushing, hand furnaces and boiling tanks in chemical plants, stock rooms and active storage areas for medium sized materials; for the safe assembly or movement of people in auditoriums, through corridors and stairways. For active work areas out of doors—loading docks.

Grade F — 2 foot-candles. For rough outdoor work such as in dredging and in stone quarries and for seating areas during baseball, boxing, and other outdoor sports.

Grade G — 1 foot-candle. To dispel darkness in large outdoor areas, such as bathing beaches, for automobile parking, lumber and other storage yards, and for industrial protective lighting.

Grade AA — 200 foot-candles. For extra fine inspection such as required in making jewelry and precision instruments. For featured items and merchandise displays in show windows in secondary business areas of large cities. (Range—minus 30% to plus 40%.)

Grade AAA — 500 foot-candles. For feature merchandise displays in show windows in main business areas of large cities. For color identification in industry. (Range—minus 30% to plus 40%.)

Grade AAAA — 1,000 foot-candles. Outdoor levels of illumination. For photography, hospital operating rooms and the daytime illumination of show windows. (Range—minus 30% to plus 40%.)

Lighting Problem Solution

The problem of applying these levels of illumination to obtain correct lighting, which may be described as one of the vital tools of production, resolves itself into four phases:

(1) Identifying the seeing task involved,

(2) Analyzing that seeing task in terms of lighting intensity, contrast, glare, and any factors entering into the seeing problem,

(3) Applying that fundamental information to determine the quantity and quality of light required, and

(4) Utilizing to best advantage the proper equipment, based on the specifications obtained as a result of the first three steps, thus resulting in the selection of "the right light for the rigt place."

Wide Range of Equipment

Far from being caught napping, the lighting industry is well prepared in this national emergency to play a conspicuous part in helping industry go over the "productive top." Lighting developments in the last few years have been extensive, and many items of streamlined lighting equipment are available for specific industrial seeing tasks.

Where mounting heights are not excessively high, there is available the RLM Dome reflector with such accessories as dust-tight glass covers, diffusing glass covers, or daylight blue cover plates, depending on the requirements of the application. Reflectors of prismatic glass are dependable tools in this field, as well as the Glassteel and Silver Bowl Diffusers, all designed to provide maximum control of light distribution.

Within more restricted mounting heights the RLM Fluorescent unit offers an ideal tool for many purposes and is being widely applied.

	Foot-candles	Grade
Jewelry and Watch Manufacturing	200	AA
Laundries	30	C+
Leather Manufacturing:		
Vats	5	E
Cleaning, Tanning and Stretching	10	D
Cutting, Fleshing and Stuffing	20	C
Finishing and Scarfing	30	C+
Leather Working:		
Pressing, Winding and Glazing—		
Light	20	C
Medium	50	B
Dark	100	A
Grading, Matching, Cutting, Scarfing, Sewing—		
Light	30	C+
Medium	100	A
Dark	200	AA
Locker Rooms	10	D
Machine Shops:		
Rough Bench and Machine Work	20	C
Medium Bench and Machine Work, Ordinary Automatic Machines, Rough Grinding, Medium Buffing and Polishing	30	C+
Fine Bench and Machine Work, Fine Automatic Machines, Medium Grinding, Fine Buffing and Polishing	100	A
Extra Fine Bench and Machine Work, Grinding—		
Fine work	200	AA
Meat Packing:		
Slaughtering	10	D
Cleaning, Cutting, Cooking, Grinding, Canning, Packing	20	C
Milling—Grain Foods:		
Cleaning, Grinding and Rolling	10	D
Baking or Roasting	20	C
Flour Grading	30	C+
Offices:		
Bookkeeping, Typing and Accounting	50	B
Business Machines—Calculators, Key Punch, Bookkeeping—Local Illumination	100	A
Conference Room—		
General Meetings	30	C+
Office Activities—See Desk Work		
Corridors and Stairways	5	E
Desk Work—		
Intermittent Reading and Writing	30	C+
Prolonged Close Work, Computing, Studying, Designing, Reading Blueprints and Plans	50	B
Drafting—		
Prolonged Close Work—Art, Drafting and Designing in Detail	50	B
Filing and Index References	30	C+
Lobby	20	C
Mail Sorting	30	C+
Reception Rooms	20	C
Stenographic Work—		
Prolonged Reading Shorthand Notes	50	B
Vault	20	C
Packing and Boxing	10	D
Paint Mixing	10	D
Paint Shops:		
Dipping, Spraying, Firing, Rubbing, Ordinary Hand Painting & Finishing	20	C
Fine Hand Painting & Finishing	50	B
Extra Fine Hand Painting & Finishing—(Automobile Bodies, Piano Cases, etc.)	100	A

	Foot-candles	Grade
Paper Box Manufacturing:		
Light	10	D
Dark	50	B
Storage	5	E
Paper Manufacturing		
Beaters, Grinding, Calendering	10	D
Finishing, Cutting, Trimming	20	C
Plating	10	D
Polishing and Burnishing	20	C
Power Plants, Engine Room, Boilers:		
Boilers, Coal and Ash Handling, Storage Battery Rooms	5	E
Auxiliary Equipment, Oil Switches, Transformers, Engines, Generators, Blowers, Compressors	20	C
Control Room—		
Switchboards and Meters	30	C+
Printing Industries:		
Type Foundries—		
Matrix Making, Dressing Type	100	A
Font Assembly—Sorting	50	B
Hand Casting	30	C+
Machine Casting	20	C
Photography—		
Dry Plate and Film	2000	AAAA
Wet Plate	3000	AAAA
Printing on Metal	2000	AAAA
Electrotyping—		
Molding, Routing, Finishing, Leveling Molds	100	A
Trimming	50	B
Blocking, Tinning	30	C+
Electroplating, Washing, Backing	20	C
Photo Engraving—		
Etching, Staging	20	C
Blocking	30	C+
Proofing	50	B
Tint Laying, Routing, Finishing	100	A
Protective Industrial	0.2	G
Receiving and Shipping	10	D
Rubber Tire and Tube Manufacturing:		
Stock Preparation—		
Plasticating, Milling and Branbury	20	C
Calendering	30	C+
Fabric Preparation—Stock Cutting and Bead Building	30	C+
Tube and Tread Tubing Machines	20	C
Tire Building—		
Solid Tires	20	C
Pneumatic Tires	50	B
Curing Department—		
Tube and Casing	50	B
Final Inspection—		
Tube	50	B
Casing	100	A
Wrapping	20	C
Warehouse	5	E
Rubber Goods—Mechanical:		
Stock Preparation—		
Plasticating, Milling and Brenbury	20	C
Calendering	30	C+
Fabric Preparation—Stock Cutting and Hose Looms	30	C+
Extruded Products	30	C+
Molded Products and Curing	50	B
Inspection	100	A
Boxing	20	C
Warehouse	5	E

For higher mounting services, high bay and medium bay reflectors serve a specific purpose in projecting useful light down to the working plane. Designed to utilize incandescent or high pressure mercury vapor lamps or a combination of both, they provide efficient and satisfactory lighting tools. The difficulty of projecting fluorescent lighting any great distance, renders this type of equipment unsatisfactory in this field.

Bench work usually requires relatively high levels of light and freedom from projected heat or glare. To provide this, some form of localized lighting is essential. Functionalized fluorescent equipments are manufactured in many types and have been widely applied over the past year, although many applications exist where, due to the size of equipment, or qualities inherent in the lamp itself, fluorescent lighting is not the best solution. Other lighting tools are available, depending on the requirements of the seeing task, such as the RLM bowls, various types of industrial intensifiers, reflector spot lamps and tubular bulb reflector lamps.

Inspection operations have always been a problem for the lighting engineer, and each one must be individually analyzed. Again, the contributions of the IES research committees in solving many involved inspection problems must be highly commended. This has resulted in the design and manufacture of many specialized lighting tools, of which, the large area, low brightness types are an example. Fluorescent lighting equipment is available as well, in a wide range, and is adaptable to multitudes of inspection processes.

In the field of exterior lighting, whether the need be for protection, construction, loading or safety, there is an abundance of the correct lighting tools to apply—dome and angle type reflectors, floodlighting units, long range projectors, refractors of prismatic glass, utility spot lights, and projector lamps.

	Foot-candles	Grade
Sheet Metal Works:		
Miscellaneous Machines, Medium Bench Work, Punches, Presses, Shears, Stamps, Welders, Spinning, Medium Bench Work	20	C
Tin Plate and Similar Inspection		B
Shoe Manufacturing (Leather):		
Cutting and Stitching—		
Cutting Tables	20	C
Marking, Buttonholing, Skiving, Sorting, Vamping and Counting—		
Light Materials	20	C
Dark Materials	100	A
Stitching—		
Light Materials	30	C+
Dark Materials	200	AA
Making and Finishing—		
Stitchers, Nailers, Sole Layers, Welt Beaters and Scarfers, Trimmers, Welters, Lasters, Edge Setters, Sluggers, Randers, Wheelers, Treers, Cleaning, Spraying, Buffing, Polishing, Embossing—		
Light Materials	20	C
Dark Materials	100	A
Storage, Packing and Shipping	10	D
Shoe Manufacturing (Rubber):		
Washing, Coating, Mill Run Compounding	10	D
Varnishing, Vulcanizing, Calendering, Upper and Sole Cutting	30	C+
Sole Rolling, Lining, Making and Finishing Processes	50	B
Soap Manufacturing:		
Kettle Houses, Cutting, Soap Chip & Powder	10	D
Stamping, Wrapping and Packing, Filling and Packing Soap Powder	20	C
Stairways, Corridors and Passageways	5	E
Steel and Iron Manufacturing:		
Billet, Blooming, Sheet Bar, Skelp and Slabbing Mills	10	D
Boiler Room, Power House, Foundry and Furnace Rooms	10	D
Hot Sheet and Hot Strip Mills	10	D
Cold Strip, Pipe, Rail, Rod, Tube, Universal Plate and Wire Drawing	10	D
Merchant and Sheared Plate Mills	20	C
Tin Plate Mills—		
Hot Strip Rolling & Tinning Machine Dept.	10	D
Cold Strip Rolling	20	C
Inspection—		
Black Plate, Bloom & Billet Chipping	30	C+
Tin Plate and Other Bright Surfaces		B
Machine Shops & Maintenance Dept., Repair Shops—		
Rough Bench and Machine Work	20	C
Medium Bench and Machine Work	30	C+
Fine Work—Buffing, Polishing, Etc.	100	A
Extra Fine Work	200	AA
Blacksmith Shop	10	D
Laboratories (Chemical and Physical) Carpenter and Pattern Shop	30	C+
Storage	2	F
Stone Crushing and Screening:		
Belt Conveyor Tubes, Main Line Shafting Spaces, Chute Rooms, Inside of Bins	5	E
Primary Breaker Room, Auxiliary Breakers—		
Under Bins	5	E
Screens	10	D
Storage Battery Manufacturing:		
Molding of Grids	20	C
Store and Stock Rooms:		
Rough Bulky Materials	5	E
Medium or Fine Material Requiring Care	10	D
Structural Steel Fabrication	10	D
Sugar Grading	30	C+
Testing:		
Rough	20	C
Fine	30	C+
Extra Fine Instruments, Scales, etc.	100	A
Textile Mills (Cotton):		
Opening, Mixing, Picking, Carding, and Drawing	10	D
Slubbing, Roving, Spinning, Spooling	20	C
Grading	100	A
Warping on Comb	30	C+
Beaming and Slashing on Comb—		
Grey Goods	20	C
Denims	100	A
Inspection—		
Grey Goods (Hand Turning)	50	B
Denims (Rapidly Moving)	200	AA
Automatic Tying-In, Weaving	50	B
Drawing-in by Hand	100	A
Silk and Rayon Manufacturing:		
Soaking, Fugitive Tinting, and Conditioning or Setting of Twist	10	D
Winding, Twisting, Rewinding, and Coning, Quilling, Slashing	30	C+
Warping (Silk or Cotton System)—		
On Creel, on Running Ends, on Reel, on Beam, on Warp at Beaming	50	B
Drawing-In—		
On Heddles and on Reed	100	A
Weaving—		
On Heddles and Reeds	10	D
On Warp Back of Harness	20	C
On Woven Cloth	30	C+
Woolen:		
Carding, Picking, Washing, Combing, Twisting, Dyeing	10	D
Drawing-In, Warping—		
Light Goods	20	C
Medium Goods	50	B
Dark Goods	100	A
Weaving—		
Light Goods	20	C
Medium Goods	50	B
Dark Goods	100	A
Knitting Machines	20	C
Tobacco Products:		
Drying, Stripping, General	10	D
Grading and Sorting	100	A
Toilets and Wash Rooms	10	D
Upholstering—Automobile, Coach, Furniture	20	C
Warehouse	5	E
Woodworking:		
Rough Sawing and Bench Work	10	D
Sizing, Planing, Rough Sanding, Medium Machine and Bench Work, Gluing, Veneering, Cooperage	20	C
Fine Bench and Machine Work, Fine Sanding and Finishing	50	B

Hints on Applying Fluorescent Lighting

Four "don'ts" which have been found to be helpful guides in the selection of the proper fluorescent lights by Oscar Cleaver, consulting engineering department, Westinghouse Lamp Division, Bloomfield, New Jersey.

Don't light continuous surfaces, (such as a long wall) with combinations of two colors of fluorescent lamps or of fluorescent and incandescent lamps unless the light is well mixed before reaching that surface. Streaks of color will likely occur.

Don't illuminate different sections of a continuous surface with different light sources (such as 20 feet with incandescent and the next 20 feet with fluorescent) for the effect will be most unpleasant due to the very apparent contrast produced. Change colors only at architectural breaks or to emphasize architectural features which normally break up the surface anyway. The use of fluorescent lighting to emphasize a window section, a wall niche, or a photo mural, etc., with general lighting either incandescent or a different color of fluorescent can be achieved with sufficient care.

Don't overlook the fact that the fluorescent lamp lacks deep red and that due to the physical makeup of the eye, the use of green pigments in decoration will make it more sensitive to red pigments, and, in a measure, help to overcome this deficiency. This may be important in department stores or offices. Avoid yellow-green pigments, however, for they may be over-emphasized.

Don't undertake the selection of any materials for your interiors unless they are seen under the color of light you intend to use, including natural daylight. This will eliminate most of the trouble you may experience in applying fluorescent lighting to your interiors.

Industrial Wiring Practice

This article, the first of a comprehensive series covering all phases of industrial wiring, discusses the basic wire tables of the Code and the types of wire available.

By B. Z. Segall

WE are now engaged in a war effort, gargantuan in proportions, unprecedented in its production accomplishments. Plant engineers, electricians, electrical contractors, and consultants are called on at all hours to provide answers to many and varied production problems. Their ingenuity, their intellectual resources and capacities, their capabilities are being taxed to the fullest extent.

It is hoped that these expositions on industrial wiring applications and installations will, in some measure, assist you in your work. This series is designed to give you *an* answer to your problem. It may give you *the* answer, but it can only assist you in as much as you will let it. The editors will welcome suggestions as to just what topics you would like to have discussed in future articles.

●

THE ACTUAL method of wiring any new plant or addition is dependent on many factors. Physical factors, involved in the actual plant construction will, in many cases, determine the wiring method. Thus a finished office section will require a completely concealed conduit system buried in concrete slabs, or concealed knob and tube in an open attic. A mill type construction will permit the use of almost any one of the types of wiring approved in the Code*. Often a combination of types will be found to be the most feasible installation. Open wire main feeders may be combined with both busways and conduit systems. Cellular metal floor raceways combined with armored wiring systems can be used quite extensively.

The recognition by the Code, for the first time, of the installation of conductors of different systems in the same raceway is of primary importance. While, in many cases, such construction is not of the best type, during these times of material conservation, Code rule 3013 may offer a solution to many problems.

In general, conductors of light and power systems may occupy the same enclosure provided:

(a) Systems are operated at 600 volts or less. This permits both d-c and a-c systems within a common enclosure without the use of a barrier separation.

(b) All wires are insulated for the maximum voltage of any system within the enclosure. Thus a 550-volt d-c railway system may be installed in the same conduit with a 220-volt, 3-wire, 3-phase system. However, if the 550-volt system has 1,000-volt insulation on its conductors, the polyphase conductors do not have to have similar insulation since the normal 600-volt covering of the a-c conductors will withstand the 550-volt d-c potential.

If the conductors are operated on systems above 600 volts, they cannot be enclosed in the same raceway with wires operating at 600 volts or less.

The actual application of any one wiring method to a plant will require some study and forethought. A new plant can be analysed from one view point, an old plant from another. Many old-

TABLE 1—ALLOWABLE CURRENT-CARRYING CAPACITIES OF CONDUCTORS IN AMPERES

Not More Than Three Conductors in Raceway or Cable

(Based on Room Temperature of 30° C. 86° F.)

Size AWG MCM	Rubber Type RW Type R	Synthetic Type SN / Type RU / Rubber Type RPT Type RP	Rubber Type RHT Type RH	Paper / Synthetic Type SNA / Asbestos Var-Cam Type AVB / Var-Cam Type V	Asbestos Var-Cam Type AVA Type AVL	Impregnated Asbestos Type AI	Asbestos Type A
14	15	18	22	23	28	29	32
12	20	23	27	29	36	38	42
10	25	31	37	38	47	49	54
8	35	41	49	50	60	63	71
6	45	54	65	68	80	85	95
5	52	63	75	78	94	99	110
4	60	72	86	88	107	114	122
3	69	83	99	104	121	131	145
2	80	96	115	118	137	147	163
1	91	110	131	138	161	172	188
0	105	127	151	157	190	202.	223
00	120	145	173	184	217	230	249
000	138	166	199	209	243	265	284
0000	160	193	230	237	275	308	340
250	177	213	255	272	315	334	372
300	198	238	285	299	347	380	415
350	216	260	311	325	392	410	462
400	233	281	336	361	418	450	488
500	265	319	382	404	468	498	554
600	293	353	422	453	525	543	612
700	320	385	461	488	562	598	668
750	330	398	475	502	582	621	690
800	340	410	490	514	600	641	720
900	360	434	519	556	...	...	...
1,000	377	455	543	583	681	730	811
1,250	409	493	589	643	...	...	...
1,500	434	522	625	698	784	...	...
1,750	451	544	650	733	...	...	...
2,000	463	558	666	774	839	...	...
CORRECTION FACTOR FOR ROOM TEMPERATURES OVER 30°C.							
C. F.							
40 104	.71	.82	.88	.90	.94	.95	...
45 113	.50	.71	.82	...	...	...	...
50 122	.00	.58	.75	.80	.87	.89	...
55 131	...	.41	.67	...	...	...	...
60 140	...	.00	.58	.67	.79	.83	.97
70 158	...	...	.35	.52	.71	.76	.93
75 167	...	...	.00	...	...	...	...
80 176	...	...	...	.30	.61	.69	.89
90 194	...	...	. .	...	.50	.61	.86
100 212	...	...	...	...	...	.51	.82
120 248	...	...	...	...	...	...	.72
140 284	...	...	...	...	...	...	.63

This table on current carrying capacities and the table on the following page describing the various conductor insulations are reprinted from the 1940 edition of the National Electrical Code.

*Throughout this series of articles, all references to the "Code" refer to the National Electrical Code, 1940 Edition. Copies of the Code will be mailed promptly upon receipt of 10c. Address requests to ELECTRICAL SOUTH, Grant Bldg., Atlanta, Ga.

er plants have gone through the throes of "growing pains" adding a new section here, a new process in some other part of the plant.

When offered a big emergency order the plant managers find themselves obliged to completely survey and redesign their electrical facilities. Whether a new design, or an addition, or a redesign of electrical wiring is to be made, there are always the problems of proper type of wire or size of busway, and voltage drop. The 1940 Code with its new tables of capacity and recognition of new rubber, sythetic and asbestos types of insulations have further added to the dilemma of those who are not more or less familiar with Code lore and practice.

Exhaustive tests on conductor insulations have been made over a period of some years; the result of these experiments form the background of the new wire tables. The new values of current capacity shown in the table have been scientifically determined and tempered with practical considerations to give reliable and safe data.

For raceway installations there are available seven classes of insulated wires. (See Table I, National Electric Code, 1940 Edition, reprinted herewith.) Each class may include two or three types of insulation. The only governing factor as to the class of a particular insulation is the thermal ability of the insulation to carry the full load current above a certain average temperature without affecting the characteristics of the insulation to such an extent as to cause its physical breakdown.

The average room temperature has been selected as 30° C. (86° F.). Any three wires in a raceway or cable installed in an average location will not deteriorate from the heat generated in the wire if currents are kept at or below the values shown in the table.

The tests show that standard "Code-rubber" insulated wire with its 20 or 25 per cent pure rubber content will break down quite rapidly if subjected to a temperature of 50° C. (122° F.). Thus, for example, three 500,000 cir mil cables having Type R (or Type RW) rubber insulation, when installed in a conduit, flexible metallic tubing, non-metallic covered cable or other types of raceways or cable, in an average residential, commercial or industrial location should not be loaded above 265 amperes per cable. Under these conditions, it will be found that the temperature of the rubber will not exceed 50° C. and the conductor insulation will not break down from excessive heating.

The second class of insulation may be operated to a temperature of 60° C. (140° F.). This class includes two rubber and one synthetic types of insulations. Type RP ("performance-grade" rubber) is similar to the standard Type R but is compounded with a larger percentage of pure rubber, about 30-40% by weight. In addition, a new thinner rubber insulation has been developed and is known as Type RU. This insulation consists of 90% by weight of Latex (unmilled, grainless rubber liquid). The use of this type of insulated wire is limited to rewiring of old conduit installations. (The thin-wall insulation wiring will be discussed in a subsequent section of this article.) In addition to the Type RU thin-wall insulation, the Type RP is also recognized in a thin wall grade. This wire, known as Type RPT, has the same insulation qualities and characteristics of the Type RP. It has, however, 1/64" less wall thickness than the Type RP. Both the Type RU and the Type RPT are limited to wire sizes Nos. 14, 12 and 10.

The third type of 60° C. (140° F.) wire is known as Type SN (Synthetic). This type of insulation has appeared in the trade journals under various names, such as American Steel and Wire Co.'s "Ampyrol," Anaconda's "Densheath," Crescent Insulated Wire and Cable Co.'s "Synthol," General Cable Corp.'s "Gencaseal," General Electric Co.'s "Flamenol," Hazard Wire Work's "Hazakrome," Simplex Wire & Cable Co.'s "Plastex," Triangle Conduit & Cable Co's "Triplastic," and U. S. Rubber Co.'s "Synrub," to mention some of these trade names. These conductors consist of annealed and tinned copper wires having only a covering of synthetic material without any inner or outer braids. This wire is also limited to use in rewiring work. It is, however, available in sizes up to and including No. 4/0.

The next class consists of a rubber compound capable of being operated at a maximum temperature of 75° C (167° F.). Type RH (heat resisting) rubber insulation has about 60% pure rubber and certain other physical aspects

(*Continued on page 31*)

CONDUCTOR INSULATIONS—600 VOLTS

Trade Name	Type Letter	Maximum Operating Temperature	Insulation	Thickness of Insulation	Outer Covering	Use
Code	R	50C (122F)	Code Grade Rubber	14-10 ..... 3/64 8-2 ..... 4/64 1-4/0 ..... 5/64 250-500 ..... 6/64 501-1000 ..... 7/64 Over 1000 ..... 8/64	Moisture-Resistant Flame-Retardant Fibrous Covering	General Use
Moisture Resistant	RW	50C (122F)	Moisture Resistant Rubber	Same as Type R	Moisture-Resistant Flame-Retardant Fibrous Covering	General Use or in Wet Locations See Section 3035
Performance	RP	60C (140F)	Performance Grade Rubber	Same as Type R	Moisture-Resistant Flame-Retardant Fibrous Covering	General Use
Heat-Resistant	RH	75C (167F)	Heat-Resistant Grade Rubber	Same as Type R	Moisture-Resistant Flame-Retardant Fibrous Covering	General Use
Small Diameter Building Wire (Heat-Resistant)	RHT	75C (167F)	Heat-Resistant Grade Rubber	14-10 ..... 2/64 8 ..... 3/64	Moisture-Resistant Flame-Retardant Fibrous Covering	General Use See 3005-d
Small Diameter Building Wire (Performance)	RPT	60C (140F)	Performance Grade Rubber	14-10 ..... 2/64	Moisture-Resistant Flame-Retardant Fibrous Covering	Rewiring Existing Raceways See 3005-e
Type RU Wire (See Note)	RU	60C (140F)	90 Per Cent Unmilled Grainless Rubber	14-10 ..... 18 Mils	Moisture-Resistant Flame-Retardant Fibrous Covering	Rewiring Existing Raceways See 3005-e
Solid Synthetic (See Note)	SN	60C (140F)	Solid Flame-Retardant Moisture-Resistant Synthetic Compound	14-10 ..... 2/64 8 ..... 3/64 6-2 ..... 4/64 1-4/0 ..... 5/64	None	Rewiring Existing Raceways See 3005-e
Asbestos Synthetic	SNA	90C (194F)	Synthetic and Felted Asbestos	14-8 ..... Synthetic ..... 20 Mils Asbestos ..... 20 Mils	Cotton Braid Thickness, 20 Mils	Switchboard Wiring
Varnished Cambric	V	85C (185F)	Varnished Cambric	Same as Type R Except 8 ..... 3/64	Fibrous Covering or Lead Sheath	Dry Locations Only Unless Lead Sheathed Smaller than No. 6 by Special permission.
Asbestos Varnished Cambric	AVA	110C (230F)	Impregnated Asbestos and Varnished Cambric	14-8 Sol ..... 45 Mils 6-2 Sol ..... 65 Mils 1-4/0 Sol ..... 75 Mils 14-2 Str ..... 60 Mils 1-4/0 Str ..... 80 Mils 250-1000 Str .. 110 Mils	Asbestos Braid Braid ..... 45 Mils	General Use Dry Locations
Asbestos Varnished Cambric	AVB	90C (194F)	Same as Type AVA	14-8 Sol ..... 50 Mils 6-4/0 Sol ..... 80 Mils 14-2 Str ..... 60 Mils 1-4/0 Str ..... 80 Mils 250-1000 Str .. 110 Mils	Flame-Retardant Cotton Braid 14-250 ..... 20 Mils 300-1000 .. 26 Mils	General Use Dry Locations
Asbestos Varnished Cambric	AVL	110C (230F)	Same as Type AVA	Solid or Stranded 14-2 ..... 75 Mils 1-4/0 ..... 80 Mils 250-1000 ..... 110 Mils	Lead Sheath 14-3 ..... 3/64 in. 2-4/0 ..... 4/64 in. 250-500 ..... 5/64 in. 550-1000 .. 6/64 in.	General Use Wet Locations
Asbestos	A	200C (392F)	Felted Asbestos	14-8 ..... 40 Mils 6-2 ..... 60 Mils 1-4/0 ..... 90 Mils 250-1000 ..... 120 Mils	With or Without Asbestos Braid Braid ..... 45 Mils	Dry Locations Only. Not for General Conduit Installation. In Raceways, only as Leads to or within apparatus. If without Braid or Moisture-resistant Treatment, Limited to 300 Volts
Impregnated Asbestos	AI	125C (257F)	Impregnated Felted Asbestos	Same as Type A	With or Without Impregnated Asbestos Braid Braid ..... 45 Mils	

Testing Routine for Motors

Industry's Maintenance Problem Increases With Three Shift Operations

By J. E. Launder*

IN THE ELECTRICAL industry, a test is a means of determining whether or not a piece of electrical apparatus will perform as indicated on its nameplate, and if not, wherein the trouble lies. Tests should all be standard and of a nature that can be easily understood by both layman and engineer—to this end instruments and methods should be employed which are standard.

I was greatly impressed recently by one statement made in reply to the question, "How do you start to find trouble in a faulty motor?" The answer was, "I look at the motor where generally 90% of the trouble is visible!"

Therein lies the key to a successful maintenance man: be observing and apply the knowledge you have gained from years of experience. This is your best asset, and a tremondous time saver. Most troubles are visible or audible, so with a little application of thought to the job at hand and a few supporting tests to check your judgment after properly looking and listening, you should be able to go right to the core of the trouble.

Tests are especially important in two places: (1) when the machine does not operate properly and the trouble must be determined; and (2) when repairs have been completed and assurance is needed that everything is in good working order.

Preliminary Checkup

First, a general inspection should be made of the entire machine without any dismantling. If the motor appears to be in running condition it should first be given a low voltage ground test in the stator winding, and if slip ring, also on the rotor winding. If the winding is clear from grounds and appears to be in reasonably good condition, the motor should be given a running test starting at half voltage and then on full voltage to see that there is no excessive unbalance.

A switchboard which can be quickly changed from 5 to 100 amperes with intermediate scales of 10, 25, and 50 amperes, a 3-phase ammeter switch, and a transformer for supplying 3 voltages, 110, 220, and 440, should be available to eliminate all switching of leads at the instruments.

If you do not make a load test then make a locked rotor test at half voltage. This information with the running current usually gives the test man a pretty good idea of the condition of the motor winding.

Bearings and Rotors

Always check bearings for looseness and set a standard below which you will not allow a motor to go into service. Ordinary practice is to allow for sizes up to 2 inch shaft diameter not over .004 inch out. And over 2 inch shaft diameter, not over .008 inch out.

It is a good idea to check rotors for balance because unbalance can cause a lot of bearing trouble and heating. With modern balancing ways or rollers the static balance is comparatively easy, especially with machines of speeds not exceeding 1800 rpm. When speeds exceed 1800 rpm, then balancing is better done dynamically. Such equipment, however, is expensive but is much more accurate. There are several types of apparatus to accomplish this.

In cases of extreme slip or lack of horse-power or torque, the test man, no doubt, would at once test for loose bars in rotor or loose connections between bars and end rings.

The locked rotor test can be used sometimes in place of a load test. Use half voltage and a prony brake, which together with the running current gives a fair idea of the motor's condition.

On squirrel cage rotors, the condition of poor joints between rotor bars and end rings is always a difficult one to detect. There are two methods which can be used for locating trouble of this kind. The first one is to run the motor without load and then reverse it at full speed, which is commonly called "plugging." A good rotor will stop almost immediately and accelerate rapidly in the new direction of rotation. A rotor with poor end connections would take appreciable time to come to a stop and accelerate very slowly in the opposite direction.

Another test for bad rotors is to apply a powerful growler to the rotor and use a thin piece of steel as a feeler over each slot. The slots with the bad bars can immediately be detected.

On single-phase, fractional horsepower, repulsion-induction motors, a torque test should be used to insure correct setting of the spring controlling the centrifugal device. If this device operates at too low a speed or too high a speed, it may give trouble on the job.

Stator Tests

If the trouble is in the stator and the burn-out is not clearly visible, the megger can be used successfully to locate grounded coils. If no megger is available, then an inside growler will be found very useful in connection with a piece of thin steel to be used as a vibrator. But by all means provide yourself with an up-to-date megger which is an improved method of locating electrical troubles. Directions come with each instrument and once you are familiar with its use you will never be without one. It indicates: faulty insulation, resistance (if high enough), open circuits, and voltage.

When a-c stators are newly rewound, no testing is necessary until the phase groups are connected and then a test is made to ground and between phase groups before dipping and baking and again after removing from the oven. The motor is then assembled and a no load running test made and the balance of current in each phase

(*Continued on page 70*)

*President of Independent Electric Machinery Company, Kansas City, Mo. This article is based on an address presented before the annual convention of the National Industrial Service Assn., in Buffalo, N. Y.

New Wiring Methods Utilized In Building Modernization

By Warner Ogden

MEN WHO work on blueprints vital to America's war effort must have shadowless lighting. Providing such lighting was one of the tasks of Ideal Electric Co., Knoxville, which was given the contract for lighting and air conditioning the seven-story Union Building, one of the office buildings in Knoxville occupied by TVA power draftsmen, construction executives, and others.

Fifty-foot candles of indirect light was the minimum requirement, with the further restriction that all shadows in the drafting department had to be eliminated.

Another problem was to do the work without interrupting in any way the activities of these men, so important to providing additional power needed to produce aluminum and other war materials. The building was occupied completely during the entire modernization projects.

Indirect lighting throughout was decided upon and some nine hundred 500-watt fixtures were required. The building had to be rewired in order to take care of the increased load.

Part of this rewiring for new circuits necessitated the pulling out of old circuits and replacing them with the new Type SN small-diameter wire. In most such circuits, the contractor took our four wires and put in eight, doubling capacity.

As the building was of concrete construction and fireproof, that too made the job different from most of those undertaken. In the words of Glen White, partner with J. S. Ward, in the Ideal Electric Co., it "was a very unusual kind of job."

"One unusual thing about it," said Mr. White, "was that there were about twice as many fixtures for given floor space. We couldn't stop work for five minutes, either. We had to do the work and maintain service on the building.

"We had to work after TVA employes left and that necessitated quite a bit of night work after regular working hours.

"Each floor required six lighting panels to take care of the new fixtures, making 42 panels in all.

"The type of fixture used was the Miller Upton indirect silver bowl fixture."

Surface metal raceway was used to a great extent.

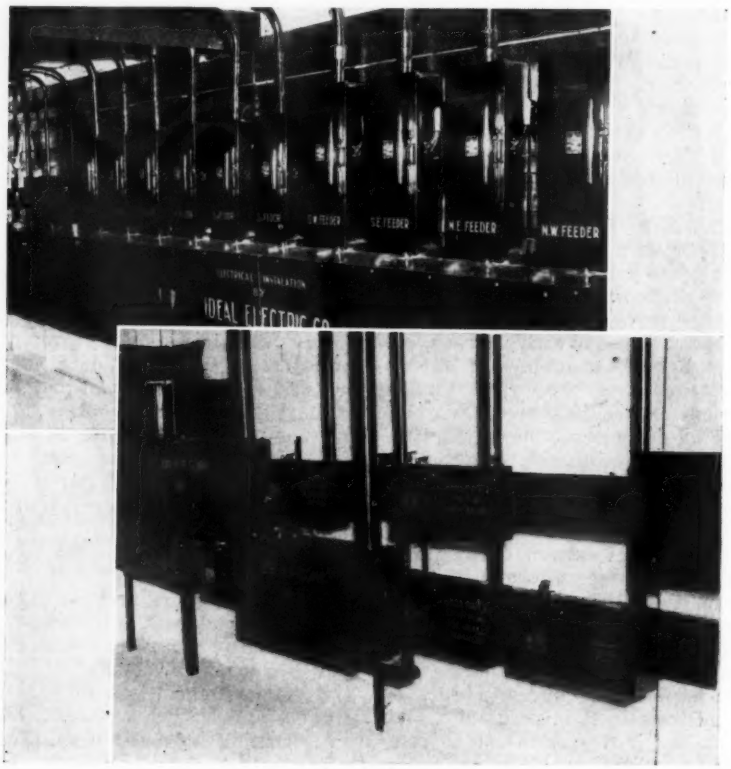
The Flex-A-Power feeder distribution systems and Flex-A-Plugs installed were among the first of their kind in Knoxville and were considered unusual for an office building. Flex-A-Power has an extremely flexible system as its various parts are constructed so that they may be interconnected by the use of standard fittings, such as elbows and tees, to suit the construction and layout of any building.

The air conditioning job was also considered unusual. The point of service for the 345 hp load begins at the power supply vault in the basement, which includes one 500-kva unit and one 450-kva three-phase transformers. From this vault service is fed to the main circuit breakers through 2,500-ampere, three-phase, four-wire Trumbull bus. The main power switch is a 1,600-ampere air circuit breaker, which feeds the new Trumbull Flex-A-Power distribution system for all air conditioning motors.

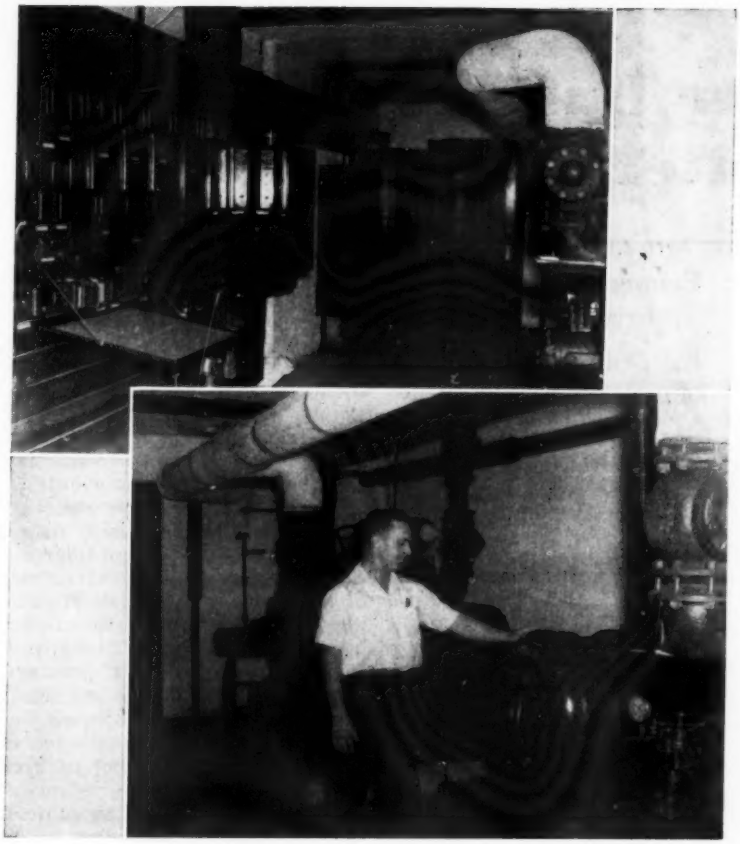
The lighting service is controlled by 800-ampere oil circuit breakers.

Two compressors, one 125 hp and one 100 hp, which operate automatically, are controlled by across the line starters.

Control and operation is completely automatic with thermostat-



Above, lighting distribution panel board installed by Ideal Electric Co. in TVA office building at Knoxville. Below, the power distribution panel board. Notice that the contractor marked each unit with white lettering.



Above, automatic control panel installed for all air-conditioning in the Union Building, Knoxville. A framed diagram of the whole lighting and air-conditioning system of the building swings out for convenient reference. Below, Scottie Kidd, building engineer, at one of the two compressors.

ic controls at different points in the building. The air is all washed.

"I don't know of any other job just like this one," declared Mr. White. "We consider it one of the best lighted and best air conditioned buildings in Tennessee."

The building is owned by Massachusetts Mutual Life Insurance Co., and is under the supervision of W. E. Fox, mechanical supervisor, and L. K. Clennon, district engineer for the company. The local agent is R. M. Perrin.

Capitalize Past Experience

Like History, electrical jobs tend to repeat themselves, and records that facilitate easy reference to past experience are invaluable.

ELECTRICAL contractors will readily agree that it is not the amount of money available that often determines the success of a job, not the materials that may be used, nor the ability of the workmen who carry out the plans, but the experience of the firm and those men who supervise the work. Little problems pop up in the fulfillment of a contract; problems that call for an exercising of the gray matter; and the manner in which they are worked out often determines the profit or loss.

In San Antonio, Texas, the Graham and Collins Electric Company has long been recognized as one of the southwest's leading electrical contractors. No small amount of credit for this fine reputation is due Fred Loth, superintendent of the contracting division, and in the following paragraphs, Mr. Loth discusses some of their experiences.

"Successful contracting depends upon three accepted practices," Mr. Loth stated. "These may be listed as follows:

"First: care must be exercised in estimating the cost of a job so that the bid entered, if accepted, will enable the firm to do the work in an efficient manner.

"Second: when a contract has been awarded, each phase of the work must be carefully studied so that the work will follow a progressive course and be completed with a minimum loss of time and effort.

"Third: careful supervision must be exercised on all work in order that these aims may be achieved and the work show a fair profit.

"One of the greatest problems confronting the electrical contractor, or any other sub-contractor for that matter, is in planning his work so that it will co-ordinate with other activities. We have worked on some jobs where the general contractor had every step of the construction carefully planned before ground was broken, and the work went along smoothly to the satisfaction of all concerned. And, we have been on other jobs where the contractor jumped about from one part of the construction to another with resultant confusion and much wasted time and effort. We endeavor to eliminate this problem by referring to previous jobs on which the general contractor has been engaged, and from this reference, we are better able to figure our estimates.

"Time and money may be saved on many jobs through close contact with the work and the development of plans that get more work done with less effort. We had the electrical work on a new retail building here, completed several months ago. Here the ceiling was twenty-five feet high on the ground floor, and illumination called for thirty-two fixtures, each six feet in diameter and weighing two hundred seventy-five pounds each.

"We saved time on this work by building a portable platform approximately twenty feet high. This platform was of sufficient size so that the fixtures could be hoisted up through the framework, after which planks were laid

(Continued on page 70)

Defend Your Business Security With Better Management

2. Proper Proration of Indirect Expense

By Arthur Roberts

This is one of a series of articles which will discuss various phases of business management from the viewpoint of the electrical contractor and appliance dealer. The first article of the series appeared in the December 1941 issue of this publication.

Questions by readers relating to their specific problems in cost accounting, department records, etc., will be given prompt attention. Address such inquiries to the editors.

DRAPER AND LONG, electrical contractors at Franklin*, made money and lost money this past year. Sounds paradoxical; nevertheless, it is true. An analysis of their records shows that they made $2,400 net profit on the business as a whole but lost $344.40 on house wiring installations. The other departments were carrying this "weak sister."

When we disclosed our findings to Phil Draper, he exclaimed, "We keep departmental records of sales, cost of sales and margins. We charge direct expense, such as rent, insurance, depreciation and interest to the departments involved and the books show that every department is holding its own. Indirect expenses are not pro-rated but charged to an account called, 'General business administration.' We watch all expenses closely. This past year, 1941, indirect expenses were $6,120 or 9 per cent of $68,000 sales, which is a safe ratio, and since we made $2,400 after deducting these expenses plus salaries for Long and myself, it indicates that the business is being managed efficiently. Please explain how you figure we lost $344.40 on house wiring installations." As we explained it to Phil Draper, we now explain it to you.

Overhead expenses fall into two groups for pro-rating: direct and indirect. The former clearly are applicable to one or more departments; the latter, such as office expense, owner's salary and delivery expense, non-applicable to any department but chargeable to the business as a whole. Nevertheless, these indirect expenses must be pro-rated in some way to the various departments to arrive at true departmental profit. Because the indirect expenses are pro-rated indirectly, they are given that name. All expenses ultimately must be charged to income-producing departments because they are the only sources that can recover these charges. Many electrical contractors, like Draper and Long, handle direct expense properly but consider indirect expense as one total instead of pro-rating it to income-producing departments, hence, they never ascertain the relative strength of their departments and manage them "in the blind," a condition doubly dangerous to success because these contractors assume that departmentization assures them profits.

From a study of this subject, we find that the recording of direct expense gives little trouble but the indirect expenses often confuse. Much of this confusion, as with depreciation, is engendered by the many involved discussions, verbal and printed, on pro-rating, allocating, distributing or apportioning overhead expense. Electrical contractors are advised to distribute overhead according to labor hours, prime cost, unit of sale or output, upon an experience percentage basis, according to the payroll, upon materials, to pro-rate selling expenses on a basis

*These are fictitious characters, of course, used merely to facilitate this discussion on the prorating of overhead expenses.

Sales		**$68,000**	**100.0%**
Cost of sales		**45,200**	**66.5**
Margin of profit		**$22,800**	**33.5%**
Direct overhead expense	**$14,280**		
Indirect overhead expense	**6,120**		
Total overhead expense	**$20,400**	**$20,400**	**30.0**
Net profit on sales		**$ 2,400**	**3.5%**

Table 1. This condensed profit and loss statement for 1941 of the hypothetical firm of Draper and Long is used as a basis for this discussion of the proration of overhead expense.

Departments	Direct Expense	%
Oil burners	**$1,531.60**	**11%**
Motor sales and installations	**2,270.80**	**16**
House wiring installations	**1,680.00**	**12**
Other lighting installations	**5,171.60**	**36**
Fluorescent lighting	**1,274.00**	**9**
Industrial installations	**2,352.00**	**16**
Total direct expense	**$14,280.00**	**100%**

Table 2. Draper and Long's departmentized direct expenses. The percentages represent each department's proportion of direct expense to the total.

different than the pro-ration of other overhead expense, etc.

No wonder many contractors assume that the pro-rating of indirect overhead expense is intricate and costly, hence, let it slide to do a half-baked job as Draper and Long did. There are different schools of thought on the subject; accountants differ on the methods of allocating overhead expense; reliable and accurate overhead distribution is a matter of dispute and doubt. However, by means of many field tests and years of experience on the accounts of electrical contractors, we have established that the following method is simple, accurate and most applicable to this field.

Draper and Long's accounts make an excellent case study because they are indicative of so many other contractor accounts in this industry, which pro-rate overhead expense incorrectly. Draper and Long's condensed profit and loss statement for 1941 was as shown in Table 1. We eliminate cents and use round figures for clarity.

The direct expenses were properly distributed to the six departments, the indirect expenses were combined under one account called, "General business administration." This routine is good accounting as far as it goes but after the indirect expenses had been totaled in one account, they should have been allocated to the various departments on the same percentage as the direct expenses. This procedure confuses many because it seems involved but it can be reduced to simple fundamentals. Here's how.

Draper and Long's direct expenses were departmentized on their books as shown in Table 2. The percentages represent each department's proportion of direct expense to total. To arrive at the proper allocation of indirect expense, we pro-rate this total with the same percentages to the same departments, basing the computation on $6,120 instead of $14,280, using the nearest round figures, which is satisfactory for this purpose. See Table 3.

Departments	Indirect Expense	%
Oil burners	$ 673.20	11%
Motor sales and installations	979.20	16
House wiring installations	734.40	12
Other lighting installations	2,203.20	36
Fluorescent lighting	550.80	9
Industrial installations	979.20	16
Total indirect expenses	$6,120.00	100%

Table 3. Here the percentages of direct expense in Table 2 have been applied to the total indirect expense in order to obtain each department's properly prorated share of indirect expense.

Now, for the final recap of Draper and Long's departmental accounts with the indirect expenses ($6,120) properly pro-rated instead of being deducted in one lump sum. This analysis is shown in Table 4.

This analysis shows how important it is to pro-rate overhead expense properly, both direct and indirect. By making all departments carry their fair share of expense, an analysis of the accounts will reveal to Draper and Long at any time the relative value of each department as a profit-builder and that is what they want to know, particularly at a time like this. But this information is not revealed unless all expense items are properly distributed.

The foregoing breakdown shows that the firm lost 7.5 per cent on sales of house wiring, figuring the percentage-on-sales return; that the motor sales and installations department made the lowest net, 2.3 per cent; and that industrial installations were most profitable, 8 per cent. However, from the standpoint of dollars and cents, fluorescent lighting sales were low with $94.10 net profit and other lighting installations high with $1,235.20 net profit.

To manage a business intelligently these days, such detailed information is necessary and it can be acquired only through allocation of overhead expense plus, of course, departmentization. With such detailed information available, Draper and Long can take steps to increase the net on the low-profit departments, eliminate the loss on house wiring and promote lighting sales energetically to get the long profits, which may entail an increase in advertising appropriation for this department or the employment of outside contact men. The fact that fluorescent sales made a bad showing should also be investigated because this new light source is a big profit-builder for many electrical contractors.

Books that serve only to record fiscal operations are just so many dead pages after the accounts are ruled off and a new year of recording begins. Bookkeeping has a much deeper function. The successful electrical contractor uses

(Continued on page 68)

Table 4. Recapitulation of Accounts with Indirect Expense Properly Prorated.

Departments	Sales	Cost of Sales	Gross Margin	Direct Expense	Indirect Expense	Net Profit	%
Oil burners	$ 7,200	$ 4,680	$ 2,520	$1,531.60	$ 673.00	$ 315.20	4.4
Motor sales & installations	18,400	14,720	3,680	2,270.80	979.20	430.00	2.3
House wiring installations	4,600	2,530	2,070	1,680.00	734.40	344.40*	7.5*
Other lighting installations	24,600	15,990	8,610	5,171.60	2,203.20	1,235.20	5.0
Fluorescent lighting	4,800	2,880	1,920	1,274.00	550.80	94.10	2.0
Industrial installations	8,400	4,400	4,000	2,352.00	979.20	669.90	8.0
Totals	$68,000	$45,200	$22,800	$14,280.00	$6,120.00	$2,400.00	--

*Loss.

New Fluorescent Fixture Design Culminates Two-Year Research

A SIGNIFICANT development in the field of fluorescent lighting came to a climax recently with the introduction of the "U.R.C. Luminaire." The initials U.R.C. stand for Utilities Research Commission and designate this luminaire as the scientific product of more than two years of research and experimentation to create a low-cost shielded fluorescent fixture offering flexibility, low brightness, easy installation, and simple re-lamping and maintenance.

The design specifications for this unit were developed in the lighting laboratories of the Commonwealth Edison Company, of Chicago, under the direction of its chief testing engineer, Edwin D. Tillson. The officials of this company, while recognizing the tremendous possibilities of fluorescent lighting, realized that certain obstacles had to be overcome in order for them to be able to assure their customers, the public, of really good, comfortable lighting.

Two-Year Research

Over a period of two years, many types of enclosed and partially enclosed fixtures were designed, made by hand and thoroughly tested. Every conceivable disposition of lamps, reflectors and shields was attempted. Experiments were made with opalescent, translucent and transparent plastics and glass.

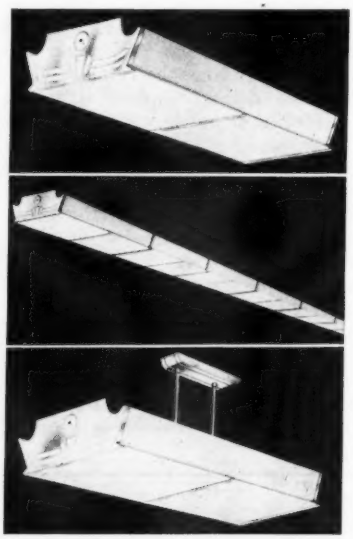
As these experiments progressed, it was apparent that a fixture could be built which avoided objectionable contrasts between light sources and ceiling. This offered an opportunity to come nearer than ever before to the best natural light obtained through windows or skylights.

A fixture of this type was built with the light source shielded so that at all ordinary seeing angles, the panels were no brighter than comfortable sky brightness. Plans and specifications were drawn up —the fixture when tried and tested met all Better Light-Better Sight requirements. The specifications were made available to any manufacturer on the condition that a production sample be submitted for test and examination. tion. Unless the production model submitted is approved, it cannot be represented or sold as a "U.R.C. Luminaire." Already the Mitchell Manufacturing Company, of Chicago, is manufacturing a unit under these specifications. (The accompanying illustrations show the new Mitchell Model 2032 "U.R.C. Research" Luminaire.)

Advantages Sought

An analysis of this unit now commercially available (utilizing four 40-watt lamps) indicates the extent to which the designers achieved their objectives.

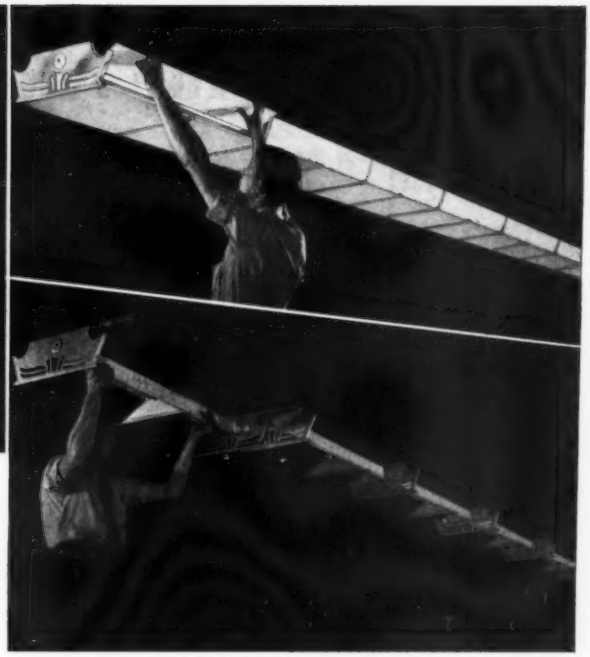
Flexibility: Three lighting applications are offered with one model, as follows: individual ceiling mounting, individual pendant mounting, and continuous row mounting. All accessories for both individual and continuous row mounting are packed with each fixture as standard equipment. For pendant mounting a separate package is available containing only the two stems and canopy. List price, $1.75. The advantages of three different types of lighting application and installation thus may be obtained from one fixture model. This eliminates the need for special ordering from factory, because the one model only need be stocked, with quick service and installation assured.



Among the first "U.R.C." fixtures commercially available is this Mitchell Model 2032. Upper photo shows single unit mounted at ceiling. Center photo shows how same unit can be mounted in continuous rows. Each unit package includes hardware required for either single unit or continuous row mounting. Below is same unit arranged for pendant mounting. A special package, nominally priced, includes the necessary stems and canopy.

Easy and Quick Installation. The U.R.C. Luminaire features an entirely new method of installation which makes possible the hanging of a fixture in a matter of minutes. First, short pieces of metal track are fastened to the ceiling by toggle bolts or Ackerman, one bolt per track. The tracks are lined up four feet apart. The fixture section then "slides into place," the sheet glass is inserted, and the splicing to existing outlet completed. Under repeated time checks, it was found that U.R.C. Luminaires could be installed in one-half to one-third the time of ordinary fixtures. Single tracks are used on individual ceiling mounting installations, and for the outer ends of continuous rows. A double track is used when units join together for continuous row installations. Both types of tracks are placed in the carton with each fixture.

Relamping and Maintenance. Relamping is quickly accomplished by removing the bottom glass panels. Side panels need not be removed. Special clips are provided to hold them when relamping. The starters are located at the bottom of the fixture, between the lamps, so that they can be removed and replaced without disturbing the lamps. Removal of two wing nuts provides easy access to inside of wiring channel. No tools are required to quickly remove all glass



The photo directly above shows the details of the side brackets, wire channel, lamp sockets, and the short pieces of track used for mounting single ceiling units. At right, below, is shown same details with units mounted in continuous row. Note that one man can mount unit after tracks have been fastened to ceiling. At right, above, the side glass is being raised and swung into special resting clips which permit removal of bottom glass panel for cleaning or relamping.

panels for cleaning. Any unit in a continuous row may be disconnected at any time, slipped out of its tracks and removed bodily if desired.

High Lighting Efficiency. With the U.R.C. Luminaire in continuous row mounting, it is possible to build up high illumination values (from 50 to 100 foot candles) yet maintain low brightness roughly comparable to normal sky brightness. Readings were taken under a single continuous row mounted 10 feet high. Sighted from underneath, an intensity of 85 foot-candles was obtained on the working surface. When three or more continuous rows were installed 10 feet apart, 90 foot-candles were obtained under the fixtures, and an average of 65 foot-candles maintained throughout the room.

Readings of three actual installations were made and disclosed the following average results: average horizontal illumination 30 inches above floor—82 foot-candles; maximum horizontal illumination 30 inches above floor—98 foot-candles; average watts per square foot—5.5; average foot-candles per watt per square foot —16.4.

The average of 16 foot-candles per watt per square foot with the U.R.C. Luminaire is important to note when compared to the efficiency of incandescent fixtures of the opal glass enclosed type which average 7½ foot-candles per watt per square foot, or the indirect incandescent type which average 4½ foot-candles per watt.

Low Brightness. As stated above, the U.R.C. Luminaire is remarkable because of its ability to provide high intensities with low surface brightness. Readings were taken with the following results: side panel viewed perpendicularly to glass surface, 0.7 cp per sq. inch; bottom panel sighted on at angle of 20 degrees above horizontal, 0.6 cp per sq. inch; bottom panel sighted on at angle of 45 degrees above horizontal, 0.9 cp per sq. inch; and bottom panel sighted on vertically from underneath, 2.8 cp per sq. inch.

From these readings, it can be noted that at all normal viewing angles, brightness does not exceed 0.9 candle power per square inch, compared to brightness of 3.9 candle power per square inch of the conventional bare tube fixture.

Despite the numerous scientific advantages claimed for it, the U.R.C. Luminaire is priced unbelievably low. The unit already commercially available carries a list price of $39.75, less tubes, which compares favorably with average 4-light bare-lamp fluorescent fixtures. This price includes mounting hardware for both single lamp use and continuous row installation. When pendant mounting is desired, however, a stem suspension set consisting of two stems with canopy and strap is available at a list price of $1.75.

Installation of the U.R.C. Luminaire in continuous rows.

Outlook for Appliance Dealers

A brief survey of the present situation; of the factors that will affect electrical appliance merchandising in 1942; and what the dealer can do to stay in the picture.

NO ROSY outlook for the immediate future of the electrical appliance dealer was presented by the marketing authorities who addressed the recent conference of the International Association of Electrical Leagues, in Washington, D. C. War had not yet been declared as these men presented their viewpoints on what's ahead for the appliance industry and how the electrical appliance specialty dealer may be kept in the picture in the difficult months just ahead, but their constructive comment still applies.

The following paragraphs excerpted from papers presented at the Conference will help many apliance dealers obtain a better understanding of the situation that will face them in the forthcoming year and how they can best prepare to meet these new and unusual conditions.

* * *

The Present Situation

In a great many cities, sales have slumped terribly since the new installment terms went into effect. Many persons bought ahead to beat the terms, to beat the excise tax and to beat price increases. Now, it seems, far too many persons haven't the 20 per cent down payment. Only time can tell when the slack will be taken up and heavy buying resumed.

In these many cities and communities there is no merchandise shortage — only a shortage of buyers having the 20 per cent down payments.

What can be done to relieve this situation? There are a number of things that can be suggested. None is new, but too many of them are not being used to the extent that the should. Often it's a case of forgetfulness or habit.

My first suggestion relates to selling. Habit is probably the worst enemy of earnings and salesmen, too easily, fall into the habit of letting down. Today they must work harder than ever, making more intelligent calls to locate the families who now have more buying power. Salesmen of insurance, Fuller brushes, and other such things, know their earnings are in exact ratio to the number of intelligent calls, assuming that their salesmanship is sound.

Benefits, economic tendencies on merchandise and prices, together with savings, must all be emphasized. To lick the new selling terms, show, for example, that a $150 electric range, at $2.00 down, and four years to pay, would cost $186. But with 20 per cent down on 18 months, the cost is $131. The saving is $55, and that ain't hay. It'll buy another nice item, or a number of smaller ones.

A revival of sales training, or better still, sales discussional periods, intelligently guided, are very much in order today as morale builders, and to permit salesmen to benefit from the experiences of others.

Cooperative shows, exhibits, etc., either downtown or in neighborhood theatres, halls or tents, usually stimulate public interest and develop prospects.

Cooperative campaigns could be especially helpful now, especially where emphasis and rewards are on the basis of salesmen's intelligent calls, and dealer floor traffic. This suggestion includes cooperating with national industry promotional programs, including, right now, the splendid Modern Kitchen Bureau's color, sound-film, "It Happened in the Kitchen."

* * *

What Will Happen to Electrical Appliances in 1942

Unfortunately even the government officials here in Washington don't know how many appliances will be made next year. True, they've had to slash production of many of the things you sell. Washer and ironer output and automatic refrigerator production has already been cut. All the other durable goods which you sell and which use material essential to the national defense effort have been cut in production or probably will be very soon.

There's a simple reason why even the men and women in the government here in Washington can't say how many appliances, how many pieces of equipment and how many feet of BX will be made next year. The defense agencies cannot humanly forecast what their needs will be twelve or even six months from now. They do know that our own national defense effort and the effort to supply other nations with materials and munitions for warfare is going to take an increasingly large part of American resources and American income. Today the defense program is absorbing 17 per cent of national income. But, as Donald Nelson has pointed out, that defense program is to be expanded. Instead of taking 17 per cent of our national income, Mr. Nelson says it undoubtedly will take 40 per cent or even 45 per cent of our national income.

Yet, although government officials can't tell us how much equipment will be made next year, their actions and the conditions which surround the national defense effort furnish some clues as to the kind and type of equipment that will be available. First, let me say that the appliance and equipment manufacturers, by and large, want to maintain the quality of the merchandise that they offer you and the consuming public. But they, like we, are patriotic and must obey orders.

Alternative materials undoubtedly will come into greater and greater use in appliance and household equipment manufacture. Vacuum cleaners are just one example, and you know the story of what the refrigerator manufacturers have done in getting around the use of critical material. This necessity of using alternate materials in many cases will be a benefit to you and your customers since it may result in even better products.

Along with the use of other ma-

terials in manufacture, there's a trend toward simplification and a reduction in the number of sizes and models of appliances that will be manufactured. This trend toward fewer sizes and models accelerated by the government may not sit too well with some dealers, in the beginning, but in the long run will simplify their problems of stocking and selling merchandise.

* * *

Will 1942 Be a Seller's Market Or a Buyer's Market

Without knowing, then, how much material will be manufactured next year or what kinds of appliances will be made, what forecasting can be done that will be of any help in preparing for next year's market?

One very vital bit of forecasting we must do is to decide whether next year will be a **seller's** or a **buyer's** market, because on that decision should hinge our whole planning.

In the face of scarcities in appliances and materials, some people in the industry have adopted the attitude of sitting back on their fannies and saying, "It will be a cinch — they'll come begging us for appliances — we don't have to do a thing in the way of selling, promotion or advertising. All we do is sit by the cash register and rake in the dough."

Maybe your program committee should have invited an optimistic prophet here in my place. On the other hand, maybe conservatism has its place in planning for a critical year like next year. At any rate, let me stick my forecasting neck way out and say that while I hope I'm wrong, next year is going to a buyer's market and we'd be smart to keep up, and even increase, the amount of selling, promotion and advertising that we're now doing.

I'm aware that the boys who think the seller's market is going to be with us next year look for still further increased employment because of national defense. They anticipate even more consumer income. They point to all the outworn appliances whose owners wish to replace them. They point to a scarcity of new appliances. These "seller's market" lads stress the fear on the part of consumers of further shortages.

Well, what's the other side of the case — the reasons why the appliance industry may face a buyer's market next year?

This year defense expenditures have created a greater national income — more jobs, higher wages, but no great change in taxes and only a slight increase in prices. We are only just entering a period of economic readjustment far greater than that ever experienced by people in this country.

There is always a time lag in the layman's awakening to changed economic conditions. And so people generally have not yet translated the billion dollar newspaper headlines on defense expenditures by the government into the one dollar personal and family adjustments that will have to be made next year by the public.

* * *

Factors That Will Affect Appliance Selling in 1942

Broader taxes, higher taxes and higher prices — none of which have affected this year's business to any large extent — will hit with a heavy blow next year.

Income Taxes—The new income tax schedule will mean higher rates for all taxpayers and lowered exemptions. More important, it will make about three million people liable for income taxes who have never paid before. How many of these people will have made preparation for this extra levy on their purchasing power in the form of savings?

Consumer Taxes—The new consumer taxes that went into effect on October 1st are bound to affect the purchasing power of everyone because they cover a large list of goods. These consumer taxes will reduce consumer purchasing power.

Higher Living Costs—Consumer purchasing power will be further cut down by mounting prices and higher costs of living. Food, rent, fuel and clothing, to cite the necessities. At the recent American Bankers Association convention it was predicted that living costs would increase 15 to 20 per cent next year.

Dr. Moulton, head of the Brookings Institution, in Washington, estimates that higher taxes and increased living costs will reduce the purchasing power of 40,000,000 people by about 25 per cent next year. Forty million is a lot of people.

New Homes—The government is discouraging the building of all new homes outside the defense housing classification.

Wired Homes—Because of priorities many utilities may not be able to extend their lines to take care of new customers.

Curbs on Installment Buying—The new installment terms on appliances are already adversely affecting the business of some dealers.

Defense Bond and Stamp Drives—Next year is bound to see a stepping up of drives to sell defense bonds and stamps. All of us will patriotically do what we can to encourage such drives. But at the same time we must realize that such efforts will cut down the spendable income of the consumer.

Anticipated Appliance Buying—Many families who have already bought appliances this year had not planned to buy them until 1942 or later on. Some of the sales we might have made in 1942 have already been made.

"Priorities" Unemployment—The curtailment of production of consumer goods, due to shortages of strategic materials, is already creating serious unemployment in many one-industry cities and town and causing serious dislocation of large groups of workers.

In the silk industries, 32,000 workers lost their jobs in two months. In the auto industry 200,000 workers may lose their jobs due to curtailment of non-defense production. One refrigerator manufacturer was forced to lay off a thousand workers. In one small city, where zippers are made, almost 10 per cent of the total workers in the city were laid off in 45 days.

Because of priorities unemployment and the lag between the time workers are discharged from consumer goods factories and re-employed by defense industries and because of the rash of strikes we're going through, those business men who expect large sales from the so-called wage earner market may be sadly disappointed.

We haven't time to cover some of the other factors like possible power shortages, loss of retail salesmen who are turning to other fields of work or the army, the stiff competition of other industries for consumer's dollars and other conditions that may discourage appliance buying. But enough factors have been cited perhaps to convince the skeptics that the so-called sellers' market will pass with 1941 and that the appliance industry has a sales job ahead of it next year.

Don't get me wrong. There will be money in 1942 and it will be

spent. But any national economic adjustment, like the one we're going in to, means selective spending — economic spending — call it what you will. This means that just because in 1941 women and their mates bought a flock of appliances, they will not necessarily buy all you can give them next year, without any prompting on our part. There will be a new weighing of values, a new refrigerator versus new furniture, a new kitchen range versus a rug for the living room, a new radio versus payment on a new car. All I ask is that we get rid of any complacency the appliance industry may have and go out and do a sales job.

* * *

What Dealers Can Do In '42

The U. S. Bureau of Census figures for 1939 show that 31 per cent of the dollar volume of radio and appliance sales is done by dealers having an annual volume of $30,000 or less. These small dealers are an important factor. What are they to do when merchandise becomes scarce?

The most obvious thing, and the one usually suggested, is to take on one or more other lines—paint, kitchen ware, novelties, toys, phonograph records, small furniture, I. E. S. lamps, china and glassware, appliance and radio service, etc. If this is done, it must be well publicized by advertising, direct-mail and telephone.

Need anything be said about chiseling? To illustrate, (according to a prominent Milwaukee distributor) with a 25 per cent operating expense, if a dealer cuts prices 5 per cent, he must obtain an increased volume of 25 per cent to break even.

Factors that help keep chiseling down are get-togethers, strong leaderships, Blue Books, shopping reports, codes of ethics, and other things of a "morale-building" nature. Of all these, however, a strong dealer leadership stands above everything else.

Utilities are beginning to recognize the challenge to dealers of scarce merchandise. In Boston, when a dealer is shy an appliance, the utility will turn one back to him. The Kansas City Power & Light Co., which is majoring on electric ranges, has bought quite a stock, and has made this available to authorized electric range dealers. No doubt, other utilities are setting up similar dealer cooperative arrangements.

The New Orleans utility, a combination gas and electric company, has set up a Pay Station Plan, whereby qualified dealers can collect the monthly gas and electric service bills. The plan started January 1, 1941, with 14 dealers; on May 1st, there were 34. In general, the plan has increased floor traffic and sales for cooperative dealers; most of these dealers have improved their stores and carry a wider range of merchandise; the public appreciates the greater convenience in paying the monthly bills; and, for the utility, the plan has decreased collection congestion and expense.

* * *

Advantage in Replacement Sales

This coming year there won't be much choice left to the dealer as to what types of appliances he gets to sell from the factory. He will pretty much have to take those sizes, models and styles which the factory gives him. The dealer obviously will not refuse to sell any consumer who wants to buy and who can either pay the cash or meet the time-payment terms the government has ordered.

And yet the dealer has a choice in the type of customers he concentrates his selling effort on. I wonder if conditions do not forecast a type of selling that will not only satisfy the wishes of the social planners in the government but also meet the needs of the appliance industry. This type of selling is a greater emphasis on the replacement market.

The great benefit to the appliance dealer in concentrating his efforts against the replacement market is that with trade-ins it is possible, despite the shortage of new appliances, to make two sales instead of one and to keep two customers satisfied. The idea of a stimulated trade-in and re-sale business to the appliance dealer should be a welcome one.

* * *

Importance of Appliance Service

Whether it's going to be hard or easy for the dealer to sell the appliances he's able to get in 1942, no dealer's usefulness to his community or his business survival is limited to the customers he sells in a single year. The 25½ million appliance owners are the appliance industry's customers. They are real reasons why the appliance dealer is in business and will be in business after the emergency, provided he takes care of his customers.

Talks my associates and I have had with appliance dealers recently convince us that not enough of them are thinking of building up their service departments to take care of repairs. Next year's conditions forecast that appliance dealers must keep alive that welcome into the homes of their customers which they now enjoy, if they do enjoy it.

Do we realize deeply enough that there's a difference between selling an appliance and keeping it in use? The habits of people in the use of appliances, carefully and expensively developed over the years, can quickly change if we don't keep telling and selling our story of the service of modern appliances. The woman, whose mixer or washing machine goes bad, can almost unconsciously revert to whipping up a batter by hand or calling in the local commercial laundry to wash and iron her clothes. The dealer who actively solicits the repair and service business on old appliances may well be quite successful in preserving a large slice of his normal decrease in dollar sales volume.

* * *

Cooperative Service Plans

The New England Gas & Electric Association has set up a new department, called the "Old Business Department," to see that customers get the fullest use and enjoyment from their appliances.

The Electric Power Board in Chattanooga has an Appliance Repair Department with twenty men; and, during the past year, rebuilt, for dealers, 146 ranges and refrigerators, so they could be put up for resale. An average of 250 service calls monthly are made from this department for local dealers. This is especially helpful to small dealers who cannot afford to maintain their own repair department.

A mid-western utility has six trucks that do small appliance repairs right out in the residential neighborhoods. The dealers there are apparently not interested in this kind of work; and the thought is that satisfied customers help promote major appliance sales, in which the dealers are, of course, keenly interested.

The latest service plan to benefit dealers is that of the New Or-

(*Continued on page 32*)

Oklahomans Visit Reddy Kilowatt

By Nat M. Johnson

FOR THE second year, Public Service Company of Oklahoma held a series of successful "Reddy Kilowatt Electrical Shows," designed to better acquaint the public with its "greatest servant—electricity," and also with the company itself.

Shows were held in the key cities, such as Idabel, Broken Bow, Hugo, Atoka, Antlers, Talihina, and Coalgate. Some were for one day only, others two days, depending on size of city and its trade area. They were held in November, scheduled to close just before Thanksgiving Day.

The entire show was produced under the supervision of D. J. Tuepker, in charge of the company's customer service program, and was made up by W. G. Chouteau, display manager; and Merle Blakely, of the advertising division of the Public Affairs Department. Mr. Tuepker managed and set up the first year's shows. Mr. Blakely and Mr. Chouteau accompanied the 1941 shows on the tour.

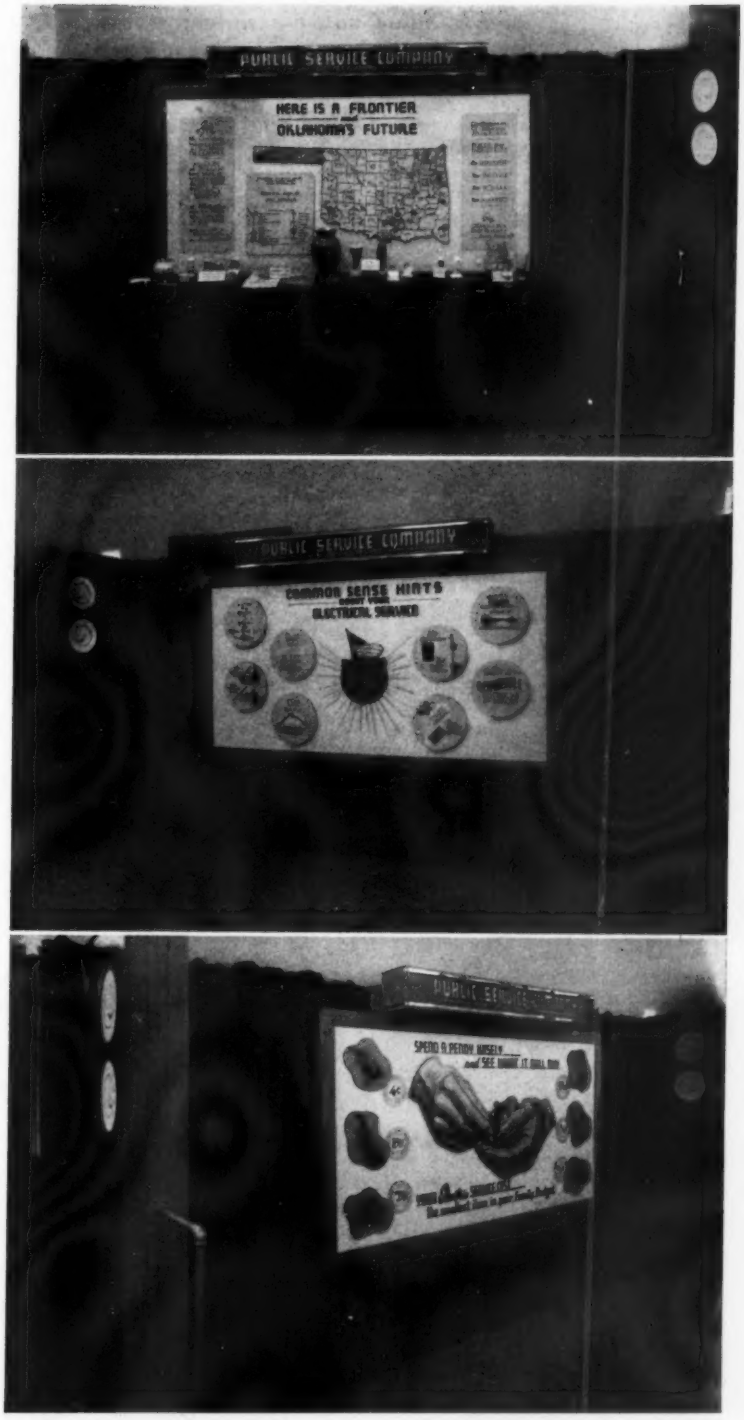
"Scenery" and "props" were constructed so as to require a minimum of personnel from the home office, one thought of the program being the utilization of the local manager and members of his staff in each town.

The show consisted of eight elaborate and attractive fixtures or booths, built in Tulsa and designed so that a visitor knowing practically nothing about electricity could go around the room and gain some idea of the industry as it affects him. An armory or similar large building was used in each city.

The show had many features to interest the layman, as well as for the student in electricity or the person who has some knowledge of the industry. One such feature was the sight test, provided with a card and test lamp so that the individual could test the intensity of the light and determine the footcandle intensity best suited to his seeing needs; then there was a tricky fluorescent lgiht, controlled at the will of the operator.

There was a booth on the cost

(Continued on page 66)



Typical booths in the "Reddy Kilowatt Electrical Show" designed by Public Service Company of Oklahoma to better acquaint its customers with some of the mysteries of their "greatest servant—electricity."

Showmanship in Sales Promotion

Good merchandising promotions will still be required in 1942. Sales volume may not reach last year's figures but competition for the consumer's dollar is just as keen.

By Geo. H. Watson

HITTING the line with aggressive promotions, varying the attack from time to time, just as does a versatile football team, the electrical appliance department of Pizitz Dry Goods Co., Birmingham, Ala., has in three years' time increased its volume from $25,000 to $300,000 per year. Increases in one year were as much as 1,500 per cent above a preceding year.

Department stores have been accused of making stepchilds out of their appliance departments, taking only what business comes to them, and then getting sour because ranges, refrigerators and radios do not sell over the counter like silks, satins and slips. But not so with Pizitz which is not only versatile with promotions but goes in for outside selling also.

The department is headed by W. C. (Bill) Allen, a triple-threat in anybody's league, who learned his signal calling first with the Birmingham Electric Company from 1920 to 1930, as merchandise manager of Florida Power & Light Company from 1930 to 1934, and then with the General Electric Company from 1934 until he joined Pizitz in 1939.

When Allen fails to gain ground with a prosaic line-buck he tries for a forward pass or end-around-end. He is on the radio daily except Sunday and it is not unusual for his department to break out with a page advertisement in the newspapers.

Back in 1939, to the surprise of his competitors, he revived the meter miser plan on refrigerators. This was at a time when business was gaining momentum and there was a green light on credits. The "15 cents a day" plan worked so well on refrigerators it was extended to ranges, this being the first time the meter plan had been so applied in the United States. The results were so great that Allen almost had to stop the game and have the scoreboard remodeled!

Such easy terms are, of course, out today, but Allen and his store still have plenty of signals to call. For instance, the concern bought up a couple of carloads of used refrigerators from an apartment house, reconditioned them and sold them in one day for $39.95 each. Later, the outside salesmen called back on the same people, took many of the old boxes in at the same price they were sold on new refrigerators, and then the old merchandise was re-sold again. Allen said that if he had the old models today, he could sell them for more than they were sold for in the first sale, this on account of the shortage of new models.

Another promotion of Pizitz

The Pisitz Company's attractive model electric kitchen.

View of expanded record department and listening rooms.

which attracted as much attention as a razzle dazzle play in a football game was a contest to determine the two oldest refrigerators in the city. Hundreds of persons entered their old boxes in this contest. First prize, an 8-foot new model refrigerator, went for a 1920 Kelvinator, oldest box, still in use, found in the contest. Second oldest was a 1924 model Frigidaire. Needless to say this contest produced a hatful of good prospects, who, incidentally, had to come to the store to fill out an entry blank in the contest.

Every week day morning for the past three years, Allen has gone on the air with a "good morning program." It comes on just after the Breakfast Club, an NBC feature, and is designed to reach the housewife just after children are off to school but before she begins her housework or goes to town. Besides the music there are three commercial announcements by Allen devoted to both new and used merchandise. Part of the time during the past two years the department has had two radio programs going, the other called a "Parade of Talent," and featuring amateur performers.

"We believe both radio and newspaper advertising are necessary," said Mr. Allen. "The radio reaches the woman during the day while the newspaper reaches the man and other members of the family in the evening."

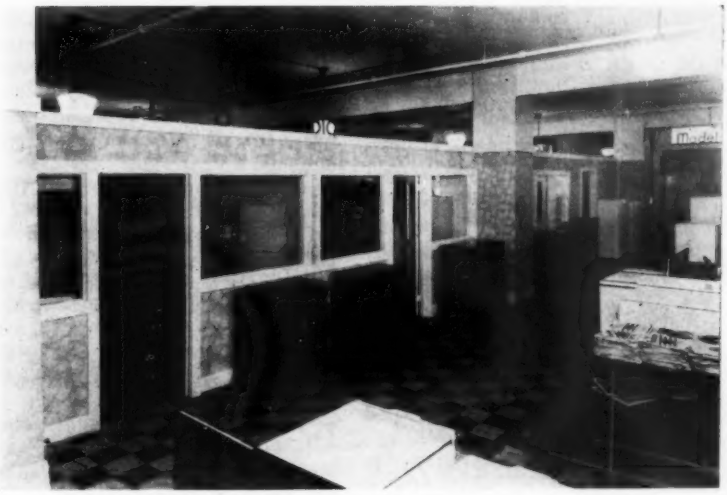
Allen employs an average sales force of 10 to 12 persons including three or more women. The latter have been found effective demonstrators of washing machines in the home, this being the only appliance demonstrated outside the store.

The commission scale is 10 per cent for outside salesmen and 5 per cent for the two floor men. New salesmen are given a three-day course of instruction and then supervisors assist them in closing deals until they are able to go on their own. Sales meetings are held thrice weekly and sound movies are freely used to inspire greater effort.

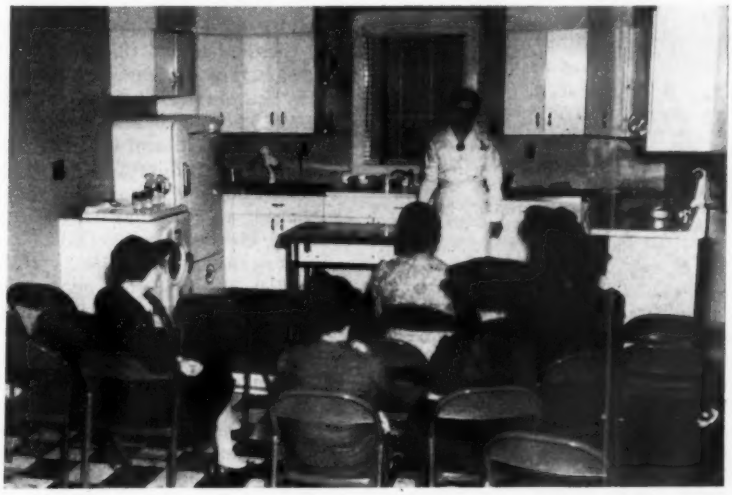
Outside salesmen are encouraged to bring or send prospects into the store where professional closers are available to do the selling. In such cases, the outside salesman gets his full 10 per cent commission. The outside force is also depended on largely to feed the cooking school. This

(*Continued on page 66*)

General view of the firm's expansive appliance department.



These radio demonstration rooms are considered essential.



Typical small group gathered for appliance demonstrations.

Utility Conditions at Year End

Industrial power demands increased 30 per cent; peak load increases were slightly greater than net additions to generating capacity; 1942 construction budgets up 10 per cent.

THE GREAT increase in demands for industrial electric power, up 30 per cent due to defense effort, was successfully met in every section of the country except for a few weeks in the Southeast where extreme drought made necessary temporary curtailment of non-defense power uses, reports the Edison Electric Institute in a year-end statement.

Due to shortages of material, to other defense demands on manufacturers of turbines and to labor difficulties, generating capacity actually installed in 1941 fell 600,000 kilowatts behind installation programs.

Peak loads increased 3,250,000 kilowatts during the year. Net additions to generating capacity amounted to 2,712,000 kilowatts, or 538,000 kilowatts less than the increase in peak loads, drawing to that extent on reserves.

Installed capacity at the end of the year was 9,600,000 kilowatts in excess of the sum of individual peak loads, compared with a margin of 10,150,000 kilowatts last year.

Scheduled for installation in 1942 are 3,655,000 kilowatts of generating capacity.

The scarcity of basic raw materials and the high state of general employment indicate that further expansion of war production must come primarily by decreasing non-defense business and by longer hours of plant operation. These factors will cause a further growth in energy output (kilowatt-hours) without much increase in requirements for new generating capacity.

Need for Capacity

The principal need for additional generating capacity appears to be for increased production of aluminum, magnesium and the products of the electric furnace. According to present defense production programs, it is expected that these items will require in 1942 and 1943 an additional 2,000,000 kilowatts of generating capacity. The present construction schedule calling for 6,400,000 kilowatts of new generating capacity in 1942 and 1943 should cover these requirements.

Capacity at End of Year

2,854,000 kilowatts of new generating capacity contributing to the public supply was installed in 1941. Of this amount electric utility companies added 1,986,000 kilowatts, municipal plants added 214,000 kilowatts and governmental plants added 654,000 kilowatts. The year's installation by electric utility companies represented 88 per cent of their programs announced a year ago.

After deducting equipment retired from service or reduced in capacity rating, the net gain was 2,712,000 kilowatts, 1,976,000 kilowatts of which was steam generating capacity, 681,000 kilowatts in hydro electric plants and 56,000 in internal combustion engines. This brings the total central station generating capacity at the end of the year to 44,350,000 kilowatts.

It is important to note that in addition to central station capacity a considerable number of manufacturing plants and mines produce their own electric power. At the end of 1941 the generating capacity of these isolated plants had reached about 12,000,000 kilowatts, bringing generating capacity in the United States to a total of 56,000,000 kilowatts at the end of the year. Manufacturing and mining plants added 1,000,000 kilowatts of capacity in 1941 and are expected to add an additional 900,000 kilowatts in 1942.

New generating capacity to be installed in 1942 by companies, municipal and government plants is estimated to be 3,655,000 kilowatts. Electric utility companies alone are planning to install 2,385,000 kilowatts. The accompanying table shows the schedule for completion of new generating capacity in 1942 and 1943 and in 1944 in so far as the schedules for that year have been announced.

Priorities have materially influenced the scheduled installations. A re-survey made December 1, 1941, of expected delivery dates of equipment showed that the 1942 schedules had been augmented several hundred thousand kilowatts by installations planned for 1941 but not completed that year, that a large amount of capacity scheduled for 1942 had been deferred to 1943, and considerably more scheduled for 1943 had been deferred to 1944. The table gives the result of this December resurvey.

Later developments, of course, may cause further deferments in schedules but the 1942 schedule is already well under way toward completion.

The sum of the December peak loads on the various systems of the country will show about 10 per cent above the figure for last year, bringing the total to approximately 34,750,000 kilowatts. The total installed generating capacity of the country was 9,600,000 kilowatts more than the sum of the individual peak loads. This margin represents unused capacity which is available to carry additional loads and capacity held in reserve against emergencies.

Utility Construction Budgets

In 1941 the electric utility companies of the United States spent in round numbers $600,000,000 on new construction. This substantially equalled the construction budget reported at the beginning of the year. The construction expenditures were: 38 per cent for generating capacity, 21 per cent for transmsision lines and substations; 37 per cent for distribution lines; and 4 per cent for miscellaneous structures.

The reported 1942 budgets are 10 per cent greater than 1941 budgets. 1942 expenditures, however, will depend upon the availability of materials and equipment. Extensions of service into new areas are prohibited under existing OPM orders except to serve

defense projects, but government announcements indicate that these projects are to be greatly expanded. In view of OPM orders, distribution expenditures are expected to be sharply curtailed but expenditures for generating stations should be 25 per cent heavier than in 1941.

Output of electricity in 1941 by all agencies contributing to the public supply totaled about 168,000,000,000 kilowatt-hours, an increase of 16 per cent over that for the previous year. Fuels produced 115,600,000,000 kilowatt-hours, an increase of nearly 19 per cent, and waterpower produced 52,400,000,000 kilowatt-hours, an increase of 10 per cent over the previous year.

The record-breaking drougth throughout the territory east of the Mississippi reduced output of hydro electric plants in New England about 8 per cent below normal and in the Middle Atlantic states about 5 per cent below normal. In the Southeastern states stream flow was seriously reduced but because more hydro generating capacity was in operation than during the previous year the net effect was only a 4 per cent reduction below the previous year's hydro electric output. In all other sections of the country the output of hydro electric plants was above their 1940 output.

Industrial and mining plants in 1941 are estimated to have produced about 40,000,000,000 kilowatt-hours, making the grand total power output from all sources 208,000,000,000 kilowatt-hours. This compares with 143,000,000,000 kilowatt-hours in 1938 when the United States produced one-half as much electricity as all the rest of the world combined.

The grand total of electric customers of all classes was 31,553,000 at the close of 1941. This represents an acquisition of 1,362,000 customers during the year and constitutes the greatest gain since 1927. Housing for defense workers caused much of this expansion. At the end of the year there were 2,350,000 farm customers, about two-thirds of whom are served by electric utility companies. Of the estimated 35,400,000 families in the United States, 27,000,000 or 76 per cent are now taking electric service.

Demand for Appliances

The year 1941 broke all records in demand for electric appliances. More ranges, refrigerators, vacuum cleaners and other appliances were sold than ever before. Sales of refrigerators exceeded 3,500,000 units, or 800,000 more than were sold in 1940, the previous high figure. Sales of electric ranges reached 750,000 compared with 436,000 in the previous year. While these large purchases of electric appliances are not likely to be repeated in 1942 because of priorities and lack of stocks, those already installed constitute a substantial backlog for sustaining the level of domestic electric use for some years to come.

New low records were made in electric rates in 1941. At a time of rising price levels, the average price of electricity for domestic service lowered to 3.73 cents per kilowatt-hour as compared with 3.84 cents the year before and 5.78 cents ten years ago. The average residential customer used 986 kilowatt-hours during the year as compared with 952 kilowatt-hours in 1940. In ten years the use of electricity per customer for household purposes has increased by 400 kilowatt-hours, while the average price has dropped until it is but 64 per cent of the former figure.

1941 Financial Conditions

Total revenues of the private companies in 1941 approximated $2,490,000,000, an increase of $213,000,000, or 9.4 per cent over the year before. According to reports of the companies which have published them for ten months of the year (with November and December estimated), operating expenses plus depreciation rose at about the same rate as revenues. Taxes, applicable to electric operations, increased by almost $100,000,000 from $413,000,000 in 1940 to $510,000,000 in 1941. This represents an increase of 23½ per cent, and taxes now consume 20½ cents of every dollar collected from all consumers of electricity.

The composite income statement of the operating electric utility companies for 1941 will show a balance for common stocks and surplus of about $416,000,000. This is about 2 per cent, less than 1940. The increase in gross earnings of about $213,000,000, as well as the decrease in interest charges of about $12,000,000, have all been absorbed in increased costs for operation and taxes. Taxes are greater than payrolls. They now exceed by 40 per cent the combined total of requirements for bond interest and preferred dividends.

Financing operations in 1941 were estimated at a total of $700,000,000 for the operating electric utility companies. This was substantially less than the $958,000,000 reported for the year before and the smallest since 1937, when $645,000,000 in securities were issued.

Kilowatts Generating Capacity Scheduled for Completion

	1942	1943	1944
Private Utilities	2,385,000	1,960,000	965,000
Municipal Plants	123,000	120,000	90,000
Government Plants	1,157,000	670,000	345,000
Total	3,665,000	2,750,000	1,400,000

Modern Industrial Wiring Practice

(Continued from page 16)

which are different from the Type R and RP compounds. A thin-wall insulation of this compound, available in sizes Nos. 14, 12, 10 and 8, is known as Type RHT.

The next four classes of insulation have eliminated rubber compounds entirely. The first of these has a temperature limitation of 90° C. (194° F.) and consists of varnished cambric, synthetic material, and asbestos in combination with each other or as individual coverings. One of these insulation coverings consists of an asbestos fibre covering of the copper wire and an overall envelope of synthetic material (Type SNA). A second type of insulation consists of a combination of varnished cambric and impregnated asbestos layers wrapped around the copper wire. A flame retardant cotton braid outer envelope is placed around this assembly (Type AVB). Finally, a third type has a varnished cambric wrap, built around the copper wire and a fibrous cov-

ering or lead sheath used for the outer covering (Type V). It should be noted that varnished cambric has a maximum operating temperature of 85° C. (185° F.). However, for the current values shown in the table the varnished cambric conductors will be operating at a safe temperature.

If the conductors are to be operated above 90° C. but not above 100° C. (230° F.—water boils under normal conditions at 212° F.), there is available a combination asbestos varnished cambric insulation covering (Type AVA). This insulation is similar to the Type AVB discussed above. It has a slightly thinner wall for some sizes but in the main differs from the Type AVB in that its outer covering consists of braided asbestos in place of the cotton braid to be found on the Type AVB. This Type AVA cable is also obtainable with a lead sheath and will be discussed more in detail in this article.

The last two classes consist of a straight asbestos insulation. A wire covered with an impregnated felted asbestos and having an impregnated asbestos braided braid can be operated at a maximum temperature of 125° C. (257° F.), (Type AI). The same type of insulation but without impregnation, that is pure asbestos, may be operated at 200° C. (392° F.), (Type A). These last two classes of wire are very limited in use and are not intended for general use in conduit or on circuits above 300 volts.

No attempt has been made to classify each type of wire as to its use as this is very clearly covered in the table given in the 1940 Code on pages 285 and 286. Other construction details are also covered by this table which is reproduced here (see page 16).

It was pointed out that the basis of the wiring capacities tables of the Code are for an average temperature of 30° C. There are certain localities and installation conditions which will require the wiring to be operated at some higher average temperature. For example the average room temperature in a boiler room or oven room may be 50° C. under normal operating conditions. This is the maximum operating temperature for Type R wire so that this type of wire could not be installed in such a location under any condition. The slightest amount of load will develop heating within the wire and thus raise the operating temperature above the safe limit.

For such an installation, as a minimum installation standard, Type RP insulated wire must be used, or if a rewiring job is contemplated, Types RPT, RU or SN may be installed if these are available within the sizes required. However, here again full utilization cannot be made of the carrying capacities of the wire because the insulations are, to begin with, preheated 20° C. above the nominal basic value of 30° C. Therefore, we can only load the wire to such a point as to add but 10° C. to the insulation temperature. This will operate the wire at a final maximum temperature of 60° C.

How much current can the wire carry under these new average operating conditions? The report which formed the basis of these new wiring tables also established these new factors. At the bottom of Table I of the Code, on page 301, will be found the correction factors for average temperatures above 30° C. Thus, if we decided that the 500,000 cir mil circuit referred to previously is still satisfactory, a Type RP insulated conductor may be substituted. It is found from Table I that for average room temperatures of 30° C. this circuit is capable of carrying 319 amperes per conductor. However, due to the higher average operating temperature, this must be reduced. Referring to the correction factors for Type RP cable at 50° C., it will be noted that only 58% of this capacity should be used to keep the maximum operating temperature below 60° C. This circuit, therefore, can now carry only: .58 x 319, or 185 amperes per conductor.

If a minimum of 265 amperes per conductor, the original rating of the Type R at 30° C., is required, then it will be necessary to go to a larger size of Type RP wire or to a conductor having an insulation with a higher operating temperature. Thus a Type RP insulated conductor capable of carrying under normal conditions a minimum of 265/.58 or 457 amperes must be installed. Thus it will be found that a 1,000,000 cir mil Type RP insulated conductor must be used to supply a load of 265 amperes in a room or location which will have an average temperature of 50° C.

If a Type RH cable is to be used then the size may be reduced since this type of insulation requires but a 25% reduction in carrying capacity at an average operating temperature of 50° C. The minimum capacity under normal conditions of the Type RH insulated conductor required for the original 265 ampere load would be: 265/.75 or 354 amperes. This would require a size 500,000 cir mil conductor, or exactly the size originally contemplated. The RH cable, however, has an insulation with better thermal operating characteristics. The 500,000 cir mil Type RH insulated cable with 354 amperes loading in a room having an average temperature of 50° C. (122° F.—approximately 24° F. above normal body temperature) would not subject the insulation to a temperature above 75° C., the maximum operating value for Type RH insulation.

Outlook for Appliance Dealers in 1942

(Continued from page 26)

leans utility. This was started September 1, 1941, with 22 cooperating dealers. It is called the "Certified Appliance Repair Shop Plan," and includes many excellent promotional pieces in colors; attention-getting advertising, including radio and motion picture theatres; and an attractive three-color identifying sign for cooperating dealers. This sign reads "Certified Electric Appliance Repair Shop."

These are straws in the wind, indicating the increasing emphasis on servicing. A recent article in the Readers' Digest pointed out, too, the need of protecting the public from padded work and padded prices. This means, in any service plan, some kind of emblem, or certified tag, or label, to identify qualified, cooperating service firms.

Even if a number of dealers add servicing, provided they can get one or more service men (now scarce), this is no assurance at all of increased business. There must be some kind of organized, cooperative effort, with plenty of public ballyhoo.

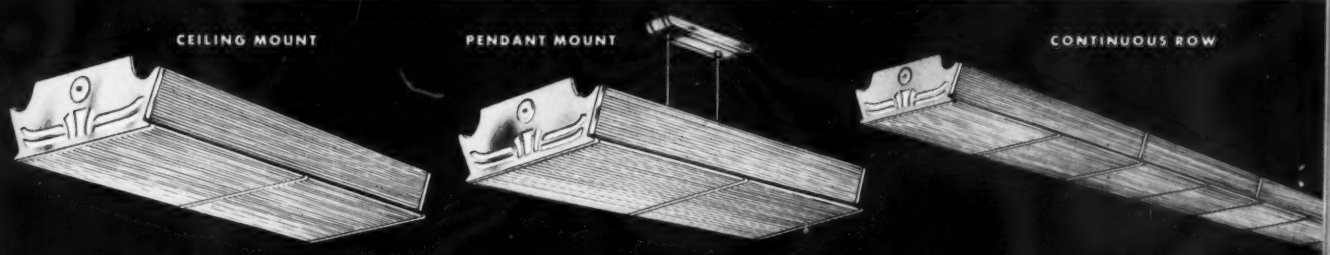
For the specialty appliance dealer this means personalizing his store — exploiting it to customers and families in the territory he serves. A new service department affords a new opportunity for customer contacts. A girl or lady with a smile in her voice (and this is essential) can accomplish much on the telephone. "Before and After" illustrations in displays and direct mail will help.

ANNOUNCING

the Revolutionary Mitchell

U.R.C. RESEARCH *Luminaire*

THE MOST SIGNIFICANT MAJOR DEVELOPMENT IN THE ANNALS OF FLUORESCENT LIGHTING!



3 TYPES OF INSTALLATIONS WITH 1 MODEL

U.R.C. LUMINAIRE
Complies with specifications and design of Utilities Research Commission
★
MADE BY MITCHELL

TWO YEARS OF INTENSIVE RESEARCH

by the Utilities Research Commission now brings you an utterly NEW, LOW-COST SHIELDED FLUORESCENT FIXTURE offering greater all-around lighting benefits than any fixture previously conceived . . . the new U.R.C. RESEARCH LUMINAIRE! Read the amazing story of this history-making lighting development on the inside pages!

ELECTRICAL CONTRACTORS!

U.R.C. IS THE NEW FLUORESCENT— *"Made to Order"* FOR CONTRACTORS!

U.R.C. IS UTILITY-DESIGNED AND BACKED
U.R.C. IS "BETTER LIGHT, BETTER SIGHT" FLUORESCENT
U.R.C. WINS INSTANT CUSTOMER ACCEPTANCE
U.R.C. IS EASIEST YET TO INSTALL, MAINTAIN
U.R.C. IS UNBELIEVABLY LOW PRICED!

IT WILL PAY YOU TO READ EVERY WORD ON THESE PAGES!

UTILITIES RESEARCH COMMISSION *Designed* IT! MITCHELL *Manufactures* IT!

What Is the U.R.C. Research Luminaire? It is an utterly NEW shielded 200-watt 4-Light Fluorescent Fixture that provides lighting vastly superior to that of any previous fixture . . . the result of over two years of scientific research and development.

Who Developed It? A committee of outstanding lighting engineers appointed by the Utilities Research Commission.

Why Was It Developed? Bare lamp fixtures and the majority of "shielded" fixtures are objectionable for many lighting applications. Serious need long has been felt for a Fluorescent unit that would meet all Better Light, Better Sight requirements, obtainable at no greater cost than ordinary fixtures. The new U.R.C. Research Luminaire fills those needs more completely than any fixture yet developed for commercial lighting application.

What Are the Advantages of the U.R.C. Over Other Fixtures? The 8 important features listed below are not claims, but *facts*, based on the findings of the Utilities Research Commission lighting engineers, whose work is independent of all lighting manufacturers. Compare these features with those of any existing fixture!

1. Extremely Flexible. Three major types of lighting installations can be made with one model: (1) Individual ceiling mounting; (2) Individual pendant mounting; and (3) Continuous row mounting. This eliminates the need for special ordering from factory, because the one model only need be stocked, with quick service and installation assured. (See chart 2 on opposite page.)

2. Higher Lighting Efficiency! With the U.R.C. Luminaire it is possible to build up higher illumination values . . . from 50 to 100 footcandles! . . . (See charts 6 and 8 on opposite page.)

3. Low Brightness. The higher lighting intensities provided are achieved with a lower surface brightness than ever before attainable. The average conventional shielded fixture today has brightness as high as 3 and 4 candlepower per square inch. Bare lamp fixtures even higher. At all normal viewing angles, the U.R.C. brightness does not exceed 0.9 candlepower per square inch!

4. Easy and Quick Installation. U.R.C. features an entirely new method of installation which makes the hanging of a fixture a matter of minutes. Metal tracks, fastened to the ceiling by toggle bolts or Ackerman, are lined up four feet apart. The fixture section simply "slides into place" on the tracks. Repeated time checks reveal that U.R.C. Luminaire can be installed in one-half to one-third the time of ordinary fixtures. (See charts 3 and 4 on opposite page.)

5. Easier to Relamp and Maintain. Relamping is quickly accomplished by removing bottom glass panels. Side panels need not be removed. Starters can be removed without disturbing lamps. No tools required to remove glass panels for cleaning. Any unit in a continuous row may be disconnected completely and easily at any time. (See chart 5 on opposite page.)

6. Design Is Modern and Functional—pleasant to the eye—suitable for office, store or any other commercial installation.

7. Meets All Better Light, Better Sight Requirements.

8. Unbelievably Low Price! Despite the fact that it represents a completely new concept of Fluorescent Lighting, with demonstrably superior features throughout, the Mitchell U.R.C. Research Luminaire costs no more than the average, ordinary 4-light fixture! The U.R.C. has a list price of only $39.95 complete, less bulbs. (When Pendant Mounting type is desired the Stem Suspension Set, consisting of two stems with canopy and strap, is available at a list price of $1.75.)

MODEL NO. 2032
MITCHELL
U.R.C. *Research Luminaire*

List Price **$39.95** Less Bulbs

(West and South $43.95)

No. 032 ST Stem Suspension Set for above $1.75

INDIVIDUAL CEILING MOUNTED

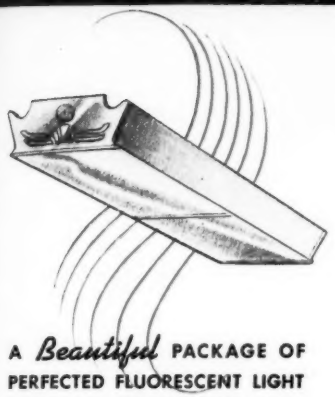
SINGLE CONTINUOUS ROW

INDIVIDUAL PENDANT MOUNTED

CONTINUOUS ROWS

A RADICALLY NEW AND BETTER FORM OF LIGHTING

JUST CHECK THESE OUTSTANDING ADVANTAGES AND COMPARE WITH ANY OTHER FIXTURE!

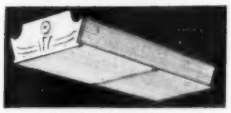


A *Beautiful* PACKAGE OF PERFECTED FLUORESCENT LIGHT FOR ANY COMMERCIAL USE

1

3 APPLICATIONS WITH ONE MODEL!

1. For Pendant Mounting



2. For Individual Ceiling Mounting

3. For Continuous Row Mounting

2

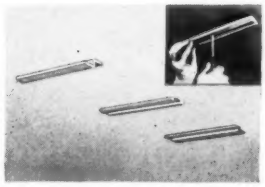
EASY TO INSTALL!

Just Slide on to Tracks

A matter of minutes to fasten each track to ceiling, slide and lock fixture in place, splice to outlet and insert glass . . . requires less time and effort to install than any other fixture

3

TWO TYPES OF TRACKS FOR CONTINUOUS ROW AND CEILING MOUNTING

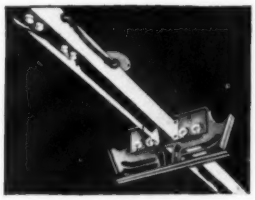


Single track used when units are mounted individually

Double track used where units join for end-to-end mounting

4

EASY TO MAINTAIN!



1. Glass panels easily removable for relamping and cleaning
2. Starters replaceable without disturbing lamps
3. Wiring channel accessible . . . just remove 2 wing nuts

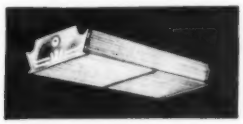
5

HIGHER LIGHT INTENSITIES!

Compared with Incandescent

4 Ft. Candles Per Watt Per Sq. Ft.

7½ Ft. Candles Per Watt Per Sq. Ft.



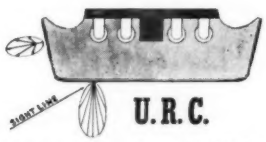
U. R. C. FLUORESCENT FIXTURE 16 fc. Per Watt Per Sq. Ft.

6

LOW BRIGHTNESS!

ORDINARY SHIELDED FIXTURES

Excessive glare, with brightness as high as 3 and 4 CP per square inch

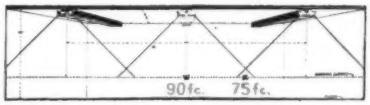


U.R.C.

Brightness does not exceed 0.9 CP per square inch

7

HIGHEST EFFICIENCY

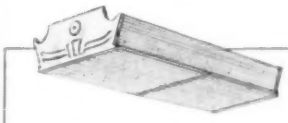


THREE CONTINUOUS ROWS
U. R. C. LUMINAIRE
IN 10-FT. SPACING
AVERAGE 65 FOOT CANDLES

8

UNBELIEVABLY LOW PRICE!

Ordinary 4-Lite Exposed Tube Fixture Average List, $38.00



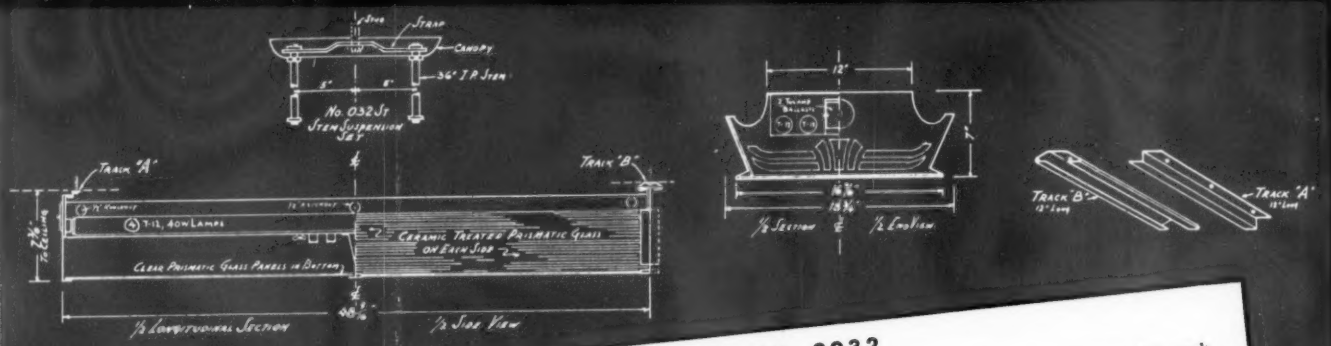
U. R. C. FIXTURE LISTS AT ONLY... $39.95

9

FOR OFFICES, STORES AND OTHER COMMERCIAL APPLICATIONS

INSTALLATION AND LIGHTING DATA

Mitchell U.R.C. RESEARCH *Luminaire*



SPECIFICATIONS—MODEL NO. 2032

This fixture is designed for mounting directly to the surface of the ceiling, either as an individual unit or end-to-end to form a continuous row. Also it can be used for pendant hanging, with Model 032-ST Stem Suspension Set, which consists of two 36" stems, canopy and strap. Unit utilizes four 40 watt, T-12 48" fluorescent lamps. Dimensions: 48¾" long, 19¾" wide, 7" high.

CHASSIS: Constructed from a single sheet of steel with trunk cover of No. 18 U.S.S.G. (.050") secured to body with two wing nuts. Two knockouts provided on the top for mounting of stems if fixture is used for pendant hanging. ½" knockouts in center of the sides, and 1⅛" from each end for connection to ceiling outlet. Surface is high reflecting, non-chipping white enamel throughout.

END PLATES: 20 gauge steel (.0375") and finished in Satin Aluminum. Knockout provided for ⅜" nipple and lock-nut, which serves to lock fixture sections together and provide raceway for feeds from one unit to another.

TRACK MOUNTING: Mounting to surface of ceiling is made by means of track sections "A" and "B," made of No. 18 U.S.S.G. steel. Track "A" is single type used on ends of continuous rows, or when single unit is surface ceiling mounted. Track "B" is double type used when two units are joined together end to end. Packed as standard equipment with each fixture are two type "A" tracks and one type "B" track.

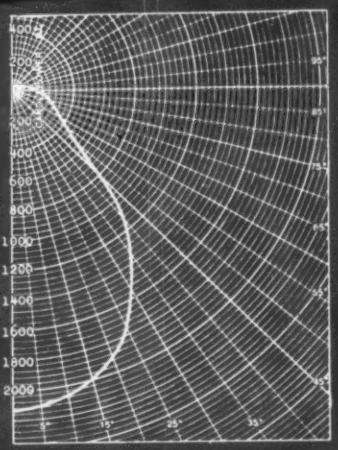
DIFFUSING PANELS: Side panels consist of double strength ribbed ceramic-coated glass. When fixture is lighted, glass is uniform throughout, and has a transmission factor of approximately 35%. Edges are ground smooth. The bottom panels are double-strength prismatic ribbed glass with transmission of not less than 85%. Edges ground smooth.

BALLASTS, STARTERS, ETC.: Latest, approved Tulamp Ballasts. Starter switches latest, standard type, located so they may be replaced without disturbing lamps. Unit bears Underwriters' Laboratories and U.R.C. Certification Labels.

Unit operates on 110-125 volts, 60 cycles, Alternating Current. (Available for 50 cycle on special order, $5.50 extra.) Shipping weight 55 lbs., packed one unit to a carton.

List Price: Model No. 2032 MITCHELL U. R. C. Luminaire.....$39.95

List Price: No. 032-ST Stem Suspension Set for above, consisting of 2-36" stems, canopy & strap $1.75



LUMINAIRE DISTRIBUTION DATA

MID-ZONE ANGLES	APP. C. P.	ZONAL LUMENS	MID-ZONE ANGLES	APP. C. P.	ZONAL LUMENS
180°			90°		
175°			85°	215	235
165°			75°	226	239
155°			65°	328	328
145°			55°	438	392
135°	6	5	45°	854	661
125°	22	20	35°	1320	829
115°	52	51	25°	1762	816
105°	134	142	15°	1984	561
95°	159	173	5°	2097	200
			0°		

URC LUMINAIRE
Complies with specifications and design of Utilities Research Commission
MADE BY MITCHELL

DESIGNED BY
UTILITIES RESEARCH COMMISSION

Manufactured by..

MITCHELL FLUORESCENT

Bulletin No. 267. Printed in U. S. A.
Copyright 1941 by Mitchell Mfg. Co.

PRACTICAL HELPS for the TRADE

Contractor - Dealer - Motor Shop

Pocket Size Tester for Electrical Appliances

Servicemen and salesmen of electrical appliances, as well as electrical contractors, will find special interest in an inexpensive, pocket-size appliance tester just announced.

The appliance tester speeds up testing, trouble diagnosis and power-consumption demonstrations by elimination of the usual connection terminals. It is only necessary to plug the tester into the line and the appliance, in turn, into a receptacle provided on the face of the tester. Two 2-position toggle switches and a 3-position rotary switch then permit instant selection of the type of measurement and the meter range desired, will all measurements of voltage, current and power consumption provided by the multi-scale, a-c/d-c meter. Heavy duty terminals are provided for current values in excess of appliance ratings.

Eighteen measurement ranges are provided. These include a-c and d-c line voltages up to 250; four d-c ampere ranges up to 25 amperes and the same for a-c; four d-c watt ranges up to 3,000 watts and duplicate a-c ranges.

Watt ranges are direct reading where the line supply is 120 volts and power factor of the appliance is unity. Curves and data supplied with the instrument permit rapid conversion for different values of voltage and power factor. The tester permits direct comparison of power consumed by various applianes. The instrument is also useful for making power measurements of motors up to several horsepower.

It is mounted in a neat hardwood case with etched metal panel, the overall dimensions being 5⅞ inches long, 3¼ inches wide and 2 inches deep.

Servicemen and salesmen of electrical appliances as well as electrical contractors will find special interest in this inexpensive pocket-size appliance tester.

Plastic Tubing Available For Refrigerator Service

With all copper under strict allocation through a ruling of the Office of Price Administration and Civilian Supply, The Dow Chemical Company has announced that a flexible, semi-transparent tubing of thermoplastic Saran is available to industry as an alternative for copper and other metal tubings.

Developed through years of research, this tough, chemically resistant tubing may be used in many applications previously demanding copper except where high temperatures and very high pressures are encountered. Also, Saran tubing has been tested and proved suitable to replace such strategic materials as nickel, stainless steel, copper and ceramics in several fields where its unusual properties are advantageous.

Saran is characterized by unusual toughness and resistance to moisture, brines, solvents, acids and alkalies. Another feature of this plastic material is that it may be used for short periods of time at temperatures of 250 degrees to 275 degrees Fahrenheit, although its strength and resistance are somewhat reduced at these elevated temperatures, Dow laboratory experts announced.

Available in sizes one-eighth inch to five-sixteenths inch outside diameter with wall thicknesses varying from .030 inches to .062 inches, this tubing may be joined by Parker Standard Tube Couplings and S. A. E. or other flare type fittings. Already the Mueller Brass Company, of Port Huron, Michigan, is developing fittings for Saran tubing which permit the construction of a tubing system in which contact between such fittings and the material conveyed is entirely eliminated.

Saran tubing joined with "B" Parker Standard Tube Couplings withstood a pressure of 1,500 pounds per square inch without rupturing or leaking. In a fatigue test, Saran was flexed through an angle of 15 degrees, 1,750 times per minute for 2,500,000 cycles without failure, while standard one-quarter inch copper tubing failed after about 500 cycles in the same test.

This indicates that Saran tubing would be superior to copper tubing for those applications where excessive vibration is encountered.

With the use of copper prohibited to non-defense industries, the introduction of Saran tubing permits maintenance of production in some instances where the lack of copper might have serious economical effect.

Refrigerator Trade-In Manual Just Off Press

The 1942 edition of the National Refrigerator Market Report, Inc., the "Blue Book" on refrigerator trade-ins, which is just off the press, will again list for $3.50 and this year a number of leading manufacturers will distribute it directly to their dealers at cost, Andrew J. Asch, Jr., publisher, has announced. These manufacturers,

it was said, are planning to have their dealers make more than ordinary use of the book during the coming year, because it is felt that due to the curtailed production of refrigerators, properly rebuilt boxes will be more important than ever.

The publishers are also making available a new advertising mat service comprising a series of newspaper ads designed primarily for the promotion of rebuilt boxes. Also included again is an article covering the essential points in respect to properly reconditioning refrigerators. Twenty-two hundred makes and models, it is said, are listed in the directory along with their trade-in values.

Mass Display Advantageous For Small Appliances

Mass display of related items is an important factor in selling small appliances, as indicated by the success of Denver Dry Goods Department Store, of Denver, Colorado, in attracting consumer attention. To catch the eye of the consumer, this up to the minute department store has arranged an interesting mass display of related appliances.

The appliance department found this a profitable way to increase business. Using the familiar psychological principle of association, they have arranged their display in such a manner as to acquaint the customer with both the product and trade name. At a glance the prospective buyer gets an idea of the related items manufactured under a certain trade name and learns to associate the products with the name and vice versa. Although a prospect may not be in the market for purchasing a particular item at the time he is in the store, he is very often impressed by the attractive display and when the opportunity presents itself for buying, he knows where to go to get what he wants.

One sale paves the way for another . . . according to this store. When the customer enters, he has a chance to see other products manufactured by the same concern and at a later date returns to purchase it.

This mass display of related small appliances is used advantageously by the appliance department of Denver Dry Goods Co., Denver, Col. The department head reports that one sale frequently leads to another and that the display stops many passersby.

Experiments Conducted on Ventilation of Fixtures

Experiments conducted by the New Orleans Electrical Inspection Department show that a series of holes in the canopy of a fixture mounted on the ceiling provides air circulation that lowers the temperature inside the fixture. The New Orleans tests were made with incandescent lamp fixtures. A somewhat similar hazard exists with fluorescent lamp fixtures mounted against combustible ceilings. The current in auxiliaries of fluorescent lamp fixtures such as ballasts or other wire wound coils, causes the coils to heat. Wherever there is excessive heat there is a possible fire hazard. In order to reduce the temperature in ceiling type fluorescent lamp bodies a ventilating manifold was suggested above the fluorescent lamp fixture. It was also thought that holes in the body of the fluorescent lamp fixtures would permit enough air circulation to keep the temperature down. Be that as it may, it does not appear to be good practice to mount fixtures so that there is only a thin piece of sheet iron between the woodwork of the ceiling and the lamp auxiliaries.

Underwriters Laboratories, Inc., have tackled the problem of flame escaping from the ventilating holes. Underwriters Laboratories have found that flame from the combustible insulation or compound for the coils and capacitors does not escape from the holes in the side of horizontally mounted fixtures in the time it takes for the fire in the fixture to smother itself from lack of oxygen. In vertically mounted fixtures or fixtures that had holes in the upper wall of the body, flame escaped from the holes and ignited the combustible material. Such experiments indicate that while some ventilation is needed to keep the temperature inside the fixture body or canopy from building up, too much air circulation is likly

to make a chimney and furnace of the fixture in the event of an insulation fire inside the fixture.

The fact is emphasized that ventilation of fixture bodies through holes in the fixture that provide air circulation will permit flame to escape from the holes under certain conditions and that only fixtures tested by Underwriters Laboratories, Inc., for the hazard are safe to use. Fixtures with holes in canopies or bodies are not approved in hazardous locations or where any considerable amount of dust or lint may accumulate.

How Fluorescent Fixtures Should *Not* Be Installed

The confusion and misunderstanding among electrical contractors and electricians as to the proper method of installing fluorescent lighting fixtures, has prompted D. J. Talbot, electrical inspector of Chicago, to discuss this subject in the Electrical Inspection Division's *Bulletin.*

"Some installations have been found in which the fixture was supported by chains or rods and then plugged into an adjacent plug receptacle, in some cases using a two conductor portable cord, which leaves the fixture ungrounded, and in other cases using a three conductor portable cord, the third wire being the ground wire. Neither of these methods is approved. In other cases the fixtures are supported by chains and a section of BX run from an outlet box down to the fixture in an effort to provide a flexible or swinging installation. This method is not approved as BX contains solid conductors and is not approved for such a flexible connection.

"In still other cases fixtures have been suspended from 8-B box covers. This means the fixture weighing anywhere from 10 to 70 pounds would be supported by the screws holding the box covers. It is not reasonable to assume that this would be a safe installation.

"A fixture should be supported by the fixture stud in the box, from condulets or unilets, or by chains, and not by the screws supporting the 8-B box cover. If a regular chain type fixture is installed, the links should have side openings instead of end openings. Cases have been reported in which open end links have opened sufficiently under the strain to allow the fixture to drop."

Lincoln's Industrial Electrical Reference

An outstanding addition to the literature of the electrical industry was made with the publication of the "Industrial - Commercial Electrical Reference" compiled by E. S. Lincoln, consulting electrical engineer. Sponsored by some eighty manufacturers of electrical equipment and supplies, and requiring more than four years to compile, the Lincoln reference book should prove a valuable aid to anyone engaged in designing, planning or installing industrial and commercial electrical equipment.

The scope of the book is indicated to some extent by its size. Nearly four inches thick, and measuring 8½ x 11 inches, it includes 1,200 pages, 1,200 illustrations, 326 diagrams, 315 tables, and more than a half-million words of text, all devoted to practical electrical engineering.

The book is divided into twenty-six sections with comprehensive indexes. The section topics include such as Electrical Fundamentals and Systems, Industrial Wiring Systems, Switchboards, Panelboards, Electrical Control, Electrical Circuit Protection, Motors and Generators, etc. Each section covers every phase of its topic from design to selection and from installation to maintenance, with complete National Electrical Code references reproduced at the points where they will be most useful.

The reference book is published by the Electrical Modernization Bureau, Room 805M, 60 East 42nd Street, New York City. The price of $15 includes a follow-up service of supplementary material which will keep the book up to date.

Electrically Heated Oven For Insulation Varnishes

Because electric heat is clean and easily controlled, it has proved to be ideal for ovens designed to bake insulating varnishes on small motor armatures and coils.

A very important step is the application of insulating varnish to the motor armatures. Electric heat is used in this process because it can be easily controlled to provide the accurate temperatures necessary for uniform results.

The armatures are first heated

This oven, heated by four G-E ribbon-type heating units, is used for baking insulating varnish on armatures of vacuum cleaner motors.

in an electric oven, then they are dipped in hot insulating varnish. They are then returned to the oven for the first baking at 260 degrees F. to 280 degrees F., for three hours. Accurate regulation of baking temperatures is very important. If underbaked, the insulating varnish remains soft and does not provide the proper insulating qualities; if overbaked, the varnish "ages" too rapidly. If the baking proceeds too rapidly, a hard skin forms on the surface, with an underbaked layer of "tacky" varnish beneath it.

A typical oven used for baking the varnish is shown here. It is heated by four ribbon-type oven heaters. As these heaters are accurately controlled, the baking proceeds at correct temperature.

After the first baking, the coils are again dipped into the insulating varnish, then placed in a second oven, similar to the first, where they are baked for 15 hours. At the end of this time the solvents have been driven from the varnish, and the resultant resinous insulating coating is both hard and elastic.

The ovens used in both baking processes are controlled automatically by thermostats.

Another important step in manufacturing motors is the re-enforcement of lead wires for the field coils of the motors. The ends of the lead wires are first dipped into molten solder, which forms a solid coating on the wire. The ends are then sheathed in a telephone-wire insulating sleeve known as

"spaghetti insulation" because of its appearance.

All-electric solder pots are used most of them 1,000-watt pots, each holding approximately 28 pounds of solder.

The pots are turned on in the morning by the watchmen before the regular shift arrives for work. When the operators arrive, the solder is in a molten stage and ready for immediate use.

Temperature Rating of Glass Cloth Insulation

Question: "Is treated glass cloth considered a Class B insulating material when used as major ground insulation in apparatus operating at temperatures about 110 degrees Centegrade?" inquires R. B. D., of Birmingham, Ala.

Answer: No. The basic glass cloth made from Fiberglas (Fiberglas is trade name Owens-Corning Fiberglas Corp.) yarns is rated as Class B material, but when the glass cloth is treated with varnish to increase its dielectric value, the increased resistance to high voltage breakdown is dependent upon organic Class A material, which will disintegrate when subjected for long periods to temperatures about 110 degrees Centigrade. For best results a combination of glass and mica, a flexible mica, should be used for ground insulation in Class B windings.

Treated glass cloth combined with mica provides a ground insulation of high initial breakdown value, which will decrease with time, but the mica will retain a safe value, thus a new winding can be subjected to high tests to weed out damaged insulation and still retain long life at normal operating conditions.

Inspection Problem Presented By Prefabricated Houses

The Louisiana Rating and Fire Prevention Bureau has been requested to inspect several prefabricated houses recently assembled in a sub-division outside the city of New Orleans, reports George Welman, electrical engineer for the Bureau. These houses were shipped in sections with some sections of the walls and partitions wired for convenence of outlets and switches. They were wired with non-metallic sheathed cable. Each section was provided with about 10 feet of excess cable for extending to the attic where the cable will tie in with the wiring in the concealed roof space and extend to other sections of the building. The wiring that will be installed in the attic and under the building can be inspected locally when the parts are being assembled, but the closed-in portion of the wiring in the walls cannot be seen unless inspected at the factory where the sections are made.

The problem is to arrange for factory inspection service and it looks like we will have to fall back on Underwriters' Laboratories, Inc., for this service. Each section should be labeled and, naturally, 100 per cent inspection service of the sections will be needed at the factory.

Air Circuit Breaker Standards Announced

The National Electrical Manufacturers' Association has announced the release of a new edition of the Large Air Circuit Breaker Standards, superseding publication No. 37-43.

This standard contains thirty pages of information inclusive of commercial standards, general standards, definitions and instructions for the installation, operation and care of large air circuit breakers.

It also contains application standards for large air circuit breakers and rating and manufacturing standards for both large air and enclosed air circuit breakers. Copies are available from NEMA Headquarters, 155 East 44th Street, New York City, for 75 cents per copy.

Progress Being Made in Fluorescent Fixture Design

Fluorescent lighting, now only in its fourth year, has already reached the same stage where a wide variety of efficient fixtures of good appearance for special purposes are available. This is quite an accomplishment when it is considered that nearly two decades were required for filament lamps to reach this stage.

One fixture especially is of interest because of its defense-work significance. A dust-tight unit is used in large numbers in the new gun-powder plants, as well as in many civilian plants where potential dust-explosion hazards exist, such as flour, textile, and cement mills. Government ordnance regulations limit to 109° C (228° F), the temperature of any part of a lighting-fixture housing exposed to the powder dust, even when it is under a thick layer of dust. The fluorescent lamp is ideal for this low-temperature work because its size, low wattage, and high efficiency lead to relatively cool operation.

The dust-tight luminaire is built of steel and is shaped like an inverted trough sealed across its bottom by a glass cover with an asbestos gasket. Inside is a porcelain enamel reflector and all ballast equipment, etc., to operate either two or three 40-watt 48-inch fluorescent lamps.

Prior to the introduction of the present 100-watt 60-inch flourescent lamp—the largest size made—lighting engineers were reluctant to recommend fluorescent equipment for lighting high bays in factory areas. However, since its entrance into the lighting field, these lamps are now effectively illuminating areas from heights of 18, 25, and even 40 feet. Literally thousands of these units are being used in aircraft factories. For example, the new Lockland, Ohio, plant of the Wright Aeronautical Corp., is equipped with over 11,000 such lamps, mounted 18 feet above the floor. As each unit is 5 feet long, this is equal to over 10 miles of light—at high level, 30 to 35 foot-candles.

Still another new type of fixture to use the 40-watt lamp makes possible literally continuous lines of light. The hoods have square open ends with connectors so they can be butted together with no apparent gap between the ends of the porcelain-enameled reflectors. The hoods form their own raceways so that separate conduit for the wiring is obviated. The reflectors can be unsnapped for cleaning without disturbing the hood or wiring.

A variety of fixtures for use in office and stores have come forward this year. For high intensities such as required for lighting of display counters and store areas, there is a new unit that uses four 40-watt 48-inch fluorescent lamps. When mounted in continuous rows on 7 to 10 foot centers and 8 to 15 feet above floor, levels of 50 to 100 foot-candles of glareless light can be provided for selling areas.

INDUSTRIAL ELECTRIFICATION
Installation and Maintenance

War-Time Responsibilities Of Maintenance Electricians

The responsibility of the industrial electrical maintenance engineer has increased greatly now that this country has become an active belligerent in the war. C. H. Christine, secretary-manager of the St. Louis Board of Trade, in a recent talk before the International Association of Electrical Leagues, pointed out some of the things with which the industrial electrical maintenance employee should be familiar and to which he will need to give some forethought in the event of an open war situation.

Important records should be duplicated and the duplicates placed in safe storage.

In England, it has been found that electric service systems stand up better than gas, as the former can be repaired more expeditiously.

Large plants may organize home-guard units of their own to protect their equipment. Stocks of spare vital equipment would be desirable. Neighboring plants might undertake a regional inventory of spare electrical equipment that might be loaned or shifted around to help maintain production. Similarly, man-power may be loaned in an emergency.

Black-out lighting would become a necessity. Centralized control of all exposed lights should be planned. For black-out purposes and protection from flying glass due to explosions and blast, the British have bricked windows up for the duration and roof window lights have been screened by wooden structures.

Maintenance men should know what and how to sand-bag. What type of damage may be done to underground cable or overhead cable. How well protected is your area by inter-connected power, in case one of your principal power plants is knocked out? Is the plant prepared for a sudden interruption of service?

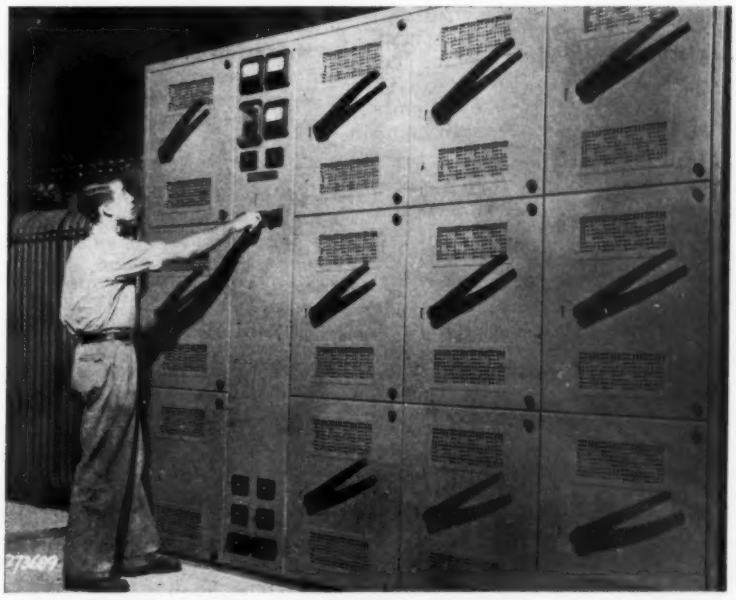
In addition to ordinary lighting, the British have installed what they call a "pilot-lighting" system, with very low intensity lights located at important points in the plant. Should the wall of a plant be damaged and the interior lights thus exposed, the main lights are switched off immediately and the pilot lights turned on.

Fourteen inch brick walls, or concrete walls, have been found to be better than steel plate, for protection of vital equipment from bomb splinters. Should a bomb-crater unearth electric cables, the speed with which they may be repaired will depend upon whether or not water or gas mains or sewers are involved. Usually, those utilities must be taken care of before the electrical repairman can work on the cables.

During an air-raid, a designated maintenance man may be the only one not permitted to go to the air-raid shelter. A steel shelter, shaped like an inverted shell, is frequently provided for him near his controls.

Lighting In Reverse For Sabotage Protection

Glare, the anathema of lighting engineers, is now welcomed as an ally in the present defense against the saboteur. Lighting engineers are using it to blind a would-be intruder to a war-materials plant while the guards remain inconspicuous in the shadows, just as one can at night see clearly into



UNIT SWITCH PANELS FOR INDUSTRIALS—Extending the unit-substation idea previously used for primary distribution centers, designers of power-supply systems for industrial plants have developed a new type of distribution unit for low-voltage work. This one, in the new plant of Curtiss Wright Corp., Airplane Division, Columbus, Ohio, consists of a transformer (to the left of the operator), a control panel, and eleven low-voltage air-breaker metal-enclosed circuits. These units are shaped so they can be stacked together like boxes in tiers and rows to form the most convenient, compact power unit. (Westinghouse photos.)

a lighted room but cannot be seen readily by those inside.

The luminaire design used in the scheme is old, the principle is simple. A Fresnel lens, in reality a miniature lighthouse beacon, throws a flat, fan-shaped beam of light, with great efficiency. A row of these luminaires is set on posts several feet away from the buildings to be protected, aimed so their light is projected slightly downward away from the buildings. The space between the luminaire and the buildings is virtually in darkness. A would-be intruder approaching the plant sees only these blinding spots of light; while the guards behind the lights see him clearly.

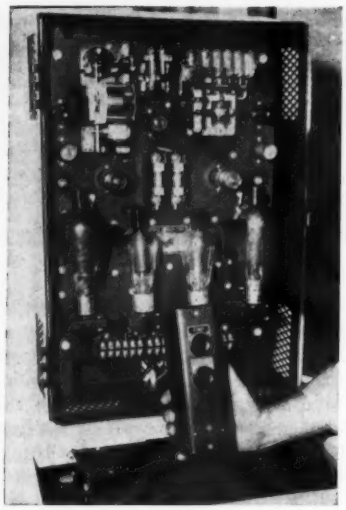
Electronic Motor Control Offers Wide Speed Range

As an outgrowth of its thyratron speed control for d-c motors, the General Electric Company has announced a new electronic control system, called Thy-mo-trol, to provide simple, stepless control of direct-current motors from alternating-current lines wherever a wide speed range is needed.

With this new development, the flexibility of d-c motors can now be combined with the economy and convenience of a-c power distribution. The Thy-mo-trol system leads to simplified machine design, reduced space requirements, and a saving in time over more complex methods of obtaining a wide speed range.

Normally consisting of three separate units — a small control station, a transformer, and a thyratron tube panel — the control is the first to provide in one equipment the means for electronically starting, stopping, accelerating, and regulating the speed of a motor. Standard units will cover motor sizes up to five horsepower, 230 volts.

The Thy-mo-trol system provides wide-range speed control without the use of motor-generator sets or gear and pulley arrangements. A single-dial control, mounted in a heavy-duty push-button station, covers the complete speed range of the motor, both above and below basic speed. The motor is automatically accelerated to preset speed quickly and smoothly without excessive current peaks. The same single dial can also be used to change speed to any value during operation.



Shown here are the control station, transformer, and thyratron tube panel comprising the new G-E electronic motor speed control called Thy-mo-trol.

Thy-mo-trol equipment can be provided for reversing service by the addition of a standard magnetic reversing switch. It can also be furnished with dynamic braking.

In operation, the change from alternating to direct current for the motor field and armature circuits is accomplished by two pairs of thyratron tubes. The control compensates for changes in armature-voltage-drop, holding motor speed constant regardless of normal-load and line-voltage variations.

The stepless speed control increases armature voltage up to basic speed and weakens the field at speeds above basic. Acceleration is automatic. Full field is held until basic speed is reached and is also automatically applied during dynamic braking.

A thermal overload relay protects the motor on sustained overloads. Fuses provide d-c short-circuit protection.

Thy-mo-trol equipment is compact and easily mounted. The control station may be located accessible to the operator, thus allowing complete control of a machine from one location. The thyratron tube panel can be furnished in various types of enclosing cases, such as those for corrosive or dusty atmospheres.

Thyratron equipment has been successfully applied to speed control problems for years. But additional equipment was usually required for starting and stopping. Thy-mo-trol now combines starting, accelerating, speed control, and stopping operations in one unit. Thus it offers a simple solution to problems such as maintaining constant speed, holding constant tension, synchronizing conveyors, and wide range speed control for machine drives without intermediate speed changing devices or special d-c power supply.

Don't Underestimate the Danger of Static Charges

Static electric charges may originate in a variety of ways. They represent a potential hazard, especially wherever volatile liquids and inflammable materials exist. The following occurrences, reported in a recent bulletin of the Bureau of Mines, are typical.

Static electricity may develop through friction of various substances, by impact, pressure, cleavage, and induction. Escaping steam through a 1/16 inch diameter hole at 75 pounds pressure blowing against a truck charged it sufficiently to give a 3/4 inch spark in five seconds.

In connection with painting tanks for storing and dispensing petroleum products, it has been found that 10,000 volts will quickly build up on insulated tanks being painted with a spray gun.

Sparks up to one inch long have been drawn from an ungrounded nozzle of a concrete gun. Use of concrete guns in tunnels with gaseous atmospheres may be dangerous unless nozzles are grounded. This can usually be accomplished by using hose reinforced with spiral wire. The object being covered should also be grounded, if possible.

Fires from static sparks are most likely to occur with liquids of low electrical conductivity and, of course, with those having low ignition temperatures. Static electricity may be generated by liquid solvent flowing through pipes or tubing, passing from vessel or tubing into air or other gaseous medium, by solvent vapor issuing from an opening into a gaseous medium, by gas passing through a liquid solvent.

A 22-inch main-drive leather belt recorded a maximum of 75,000 volts from static electricity.

A naval officer wearing a fur coat and rubber boots in walking

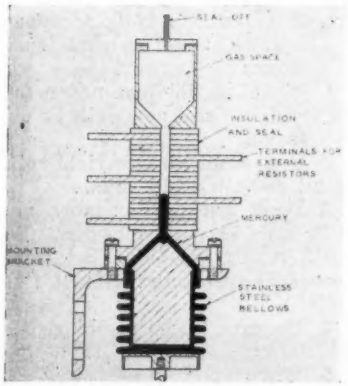
to his garage developed a static charge which ignited the gasoline in the tank of his car.

Leaking distillate being caught in a bucket which was not grounded was ignited as an attendant went over to remove and empty it, the spark either coming from his hand to the pail or vice versa. Oil or gas tanks being cleaned with steam should have the tank and steam line electrically bonded together and grounded.

A million times as much static may be developed at low humidity as at high humidity. One authority states that 15% of all gasoline fires are caused by static electricity, and believes that a like number attributed to unknown causes might well be placed in the same category. Grounding is considered the most effective means for removing or preventing static. Humidification is probably the next most effective measure.

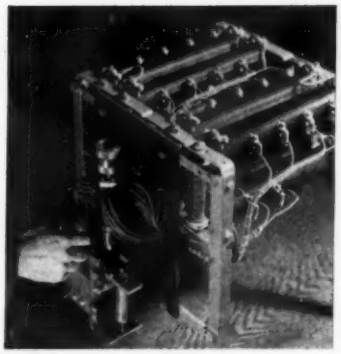
Amplification of 100,000 In New Mercury Control

A column of mercury in a glass tube, one of the oldest devices for measuring temperature or atmospheric pressure, has been turned experimentally into an ingenious new device that may become the basis of one of the most versatile systems of regulating speed of a motor.



Called the "Mercurystat," this new control element may prove to be a most versatile system of regulating motor speed. It consists of electrical contacts spaced along a vertical tube having a compressible bellows at the lower end.

Instead of using a glass bulb below the column to act as a mercury reservoir, Westinghouse Research Engineer K. A. Oplinger uses a stainless-steel bellows. Sealed into the column rising above it are electrical contacts, spaced roughly 1/16 inch apart. As the bellows is compressed, the mercury rises and successively short-circuits contacts, forming thus a series of mercury switches. Because of the large ratio of bellows area to the cross section of the capillary, only a slight compression of the bellows raises the mercury the full height of the tube. In fact, in an experimental model only 0.015 inch movement of the bellows covers or uncovers the 40 contacts, a ratio of about 150 to 1. The bellows can be actuated by a mechanical driver, such as a cam or lever, so it can be used as a speed-control device, contacts in the tube controlling a motor rheostate; or an electromagnetic element can make it respond to changes in voltage or current.



Here the new control element is shown mounted and connected to control a motor rheostat.

The device is, in effect, an amplifier. The full mercury column can be raised by a change of 0.05 watt in the coil driving the bellows. Change in power controlled may be 5,000 watts; thus power amplification is 100,000.

Because of low voltage between adjacent contacts and because contacts are sealed in a hydrogen atmosphere, relatively large currents can be handled. The device was tried on a 220-volt d-c circuit, current being varied from 12 to 30 amperes. After 5 million operations the contacts showed no sign of wear. It is insensitive to either changes in temperature or pressure.

Photoelectric Door Control Saves Plant $30 per Day

The Brown and Williamson Tobacco Company, Louisville, Ky., is saving as much as $30 per day in operating costs as a result of the recent installation of photoelectric control on the doors of its shipping and receiving departments. Substantial savings in heating costs are also being made.

With the shipping and receiving departments operating on a 24-hour-a-day basis, their six huge

Doors which are controlled automatically by gear-motor with photoelectric control save as much as $30 per day in operating costs in this shipping and receiving department of a southern tobacco manufacturing plant.

doors must be continually opening and closing to allow for the passage of incoming loads of leaf tobacco and outgoing shipments of cigarettes and smoking tobacco. These doors were previously operated manually at comparatively high cost, both in actual operating expense and in time lost in signalling for the doors to be opened.

The previous expense of heating these departments was also very high because the doors opened directly to the outer air and the slow manual operation of them allowed much heat to be lost. In fact, the doors were sometimes allowed to remain open continually, there being no time to operate them. These facts not only resulted in higher costs, but also made it difficult to maintain comfortable working temperatures for employees of the shipping department.

Now, however, with the installation of photoelectric control equipment, incoming or outgoing shipments approaching the doors cut light beams focused on phototubes. This starts operation of the equipment and the doors open automatically and close when the shipment has passed beyond the light beams. As a result, not only are operating time and costs, as well as heat losses, cut to a minimum, but also comfortable working temperatures for employees are easily maintained.

Besides four photoelectric relays and light sources, the equipment controlling each door includes one 1/4 hp., concentric gear motor; two limit switches for controlling the door's travel; a 500-watt, 220/110-volt, single-phase transformer; and supplementary control devices. A limit switch, mounted at the top of the door on a hinged panel is used as a safety device to protect against persons being caught in the door. This switch operates the control circuit and reverses the door.

Increasing Rewind Life of Series Motor Armatures

By A. C. Roe

When "series motors" such as used on cranes, hoists, mine or mill motors, etc., start to give trouble with the field coils or armature windings, then serious consideration should be given to both sections of the motor, particularly when an armature must be rewound, as a rewound armature can soon be ruined if placed in a frame with faulty field coils.

The condition of the main and cummutating field coils, in series type motors, has a direct bearing on the rewind life of an armature winding, and when changing defective armatures, the field coils should all be removed for thorough checking, as one or more field coils with weak internal insulation, that is short circuited turns or layers, will soon ruin a good rewound armature. Also shorted field coils cause sparking, rapid brush wear, and increase commutator pitting, etc.

The reason for this statement becomes obvious, when we consider the motor circuit of the series type motors, as used in mine, crane, mill and traction service, where the current flowing in the armature and field circuit is of the same value. Thus the field coil conductors are of large cross-sections to carry the current without excess heating, and there are few turns per coil so that one turn represents many ampere-turns.

The motor torque is directly proportional to the product of the field strength and armature current. Weakening the field will cause the motor to speed up, but for certain torque or load conditions, a weak field caused by shorted turns in one or more field coils, means that more current must be drawn to supply the needed torque or horsepower. Thus the armature circuit as well as the field circuit is subjected to higher current values. A new armature installed in a frame with weak field coils, therefore, is subjected to overload conditions from the very start, and its useful life shortened by this constant overloading.

In a series motor a field coil with one or more turns shirt circuited does not heat up. On the contrary, the remaining good field coils are hotter than the shorted coil. A shorted field coil throws an added load on the armature winding, and also on the good field coils. The reason for this is that the resistance of the shorted coil is less. Then with increased current required to meet load requirements, the I^2R losses of the good coils increase, while the losses in the shorted coil are normal, or in some cases less than normal, depending upon the degree of short circuit.

Likewise, when an armature winding is burned out, an additional load has been placed on the field circuit. The moral of this story is, "When a motor is out of service for armature or field trouble, *remove all field coils* and only replace field coils that are internally and externally in unquestionable condition."

Field Coil Maintenance

The condition of the field coils in a series motor has an important bearing on the life of an armature; and it is recommended that when an armature is re-wound with new coils, all old field coils, both main and commutating, be removed from the frame.

The frame used for the rewound armature should be equipped with either all new coils, or all re-built coils; or in other words, only coils in A-1 condition internally and externally should be used with a re-wound armature.

It is good maintenance practice to remove all field coils, main and commutating, when a motor is shopped for an armature burnout, or with one or more shorted or grounded field coils.

Then all field coils removed should be carefully checked for weak internal insulation, and all doubtful and bad coils scrapped.

Five rules should be established, as follows:

1. When re-fielding, never mix repaired, old and new coils in any one frame.
2. Use either all new field coils, or all re-built field coils.
3. Don't put one or more new field coils in with old coils. For quick repairs of this kind, when necessary, use only re-built field coils.
4. Be sure that the polarity of all field coils is correct.
5. When an armature is rewound with expensive Class B insulated coils, don't take a chance on questionable field coils.

Why All Good Field Coils

The reason for the above suggestion is based on the principle of the series motor where we know that the same current value flows in both armature and field circuit.

We also know that for any change in field flux or ampere turns, that the armature tends to adjust its speed to develop the proper balancing counter electromotive force to maintain the proper current value.

(*Continued on page 65*)

ELECTRICAL DISTRIBUTION
Engineering and Operation

Electrical Engineers Discuss Power and Industrial Topics

FEATURING a number of papers of specific interest to power distribution engineers and industrial utilization engineers, the Southern District Meeting of the American Institute of Electrical Engineers, held in New Orleans, December 3 to 5, attracted nearly record attendance for this District with approximately 400 engineers and students registered.

Among the papers presented relating specifically to the transmission and distribution of electric power were: "Lightning Phenomena and Its Behavior on Transmission Lines," by G. D. McCann, Westinghouse Electric and Mfg. Co., Pittsburgh; "Electrical Design of TVA Hydro-electric Stations," by Raymond A. Hopkins, Tennessee Valley Authority; "Carrier-Current Relaying and Communication," by T. D. Talmadge and M. S. Merritt, both of Tennessee Valley Authority; "Factors Contributing to Improving Electric Service by Means of High Speed Switching and Utilization of Stored Energy," by J. T. Logan and J. H. Miles, both of Georgia Power Company, Atlanta; "Low Voltage Underground Networks," by P. B. Boyd, Georgia Power Company, Atlanta; "Parallel Operation of Load-Ratio-Control Transformers Operating in Parallel and in Networks," by Frank M. Starr, General Electric Co., Schenectady, N. Y.; and "Ceramic Electrical Insulators," by F. J. Stevens, American Lava Corp., Chattanooga.

A general session opened the meeting with James M. Todd, New Orleans consulting engineer, presiding. An address of welcome by J. E. Housley, of Aluminum Company of America, and vice-president of the Southern District, AIEE, was followed by a brief discussion on the general condition of the Institute by the national secretary, H. H. Henline.

"The Potential of Inter-American Economics" was the subject of Charles A. McQueen, of the Office of the Coordinator of Inter-American Affairs, Washington, D. C. "Technology and finance are the economic tools being wielded in an effort to prevent the Americas' occupying an inferior colonial position in a Hitler-dominated world," he said.

Mr. McQueen traced the trade relations between the United States and the Latin American countries over a long period. He pointed out that trade with the countries to the south has been passive on this country's part. The outbreak of the war led to the conception of an inter-American co-operative plan to supply the southern nations with essential materials and machinery. "The plan is not yet perfect, but it is being improved," observed Mr. McQueen. "In a physical and productive sense, the hemisphere lacks little of self-containment. By a full use of materials and ingenuity, we can readily find substitutes for what we lack."

Left to right: (1) James M. Todd, consulting engineer, New Orleans, and general chairman of the Southern District AIEE Meeting; B. P. Babin, Westinghouse Elec. & Mfg. Co., New Orelans, and chairman of New Orleans Section; and J. O. Shepherd, Southern Bell Tel. & Tel. Co., Atlanta. (2) W. S. Leake, General Electric Co., New Orleans; C. A. McQueen, Coordinator of Inter-American Affairs, Washington, D. C.; and F. E. Johnson, Jr., New Orleans Public Service, and secretary of New Orleans Section. Mr. McQueen addressed the meeting.

Dean Joseph Weil, of the University of Florida, Gainesville, also addressed the opening session of the meeting. "The South is awakening to her opportunity," he said, and described the research that is being initiated in many southern schools relating more specifically to problems of the South.

A special evening session was neld for the presentation of a comprehensive discussion on lightning and its behavior on transmission lines by Dr. Gilbert D. McCann, of Westinghouse Electric Mfg. Co. Interesting features of Dr. McCann's lecture were Kodachrome slides of lightning phenomena and the mechanical wave demonstrator developed by Westinghouse engineers for the illustration of transient phenomena on electrical transmission and distribution circuits.

"Every time you take a breath, nearly 100 bolts of lightning strike somewhere in the world," Dr. McCann asserted. "Records compiled by lightning investigators and weather bureaus disclose that about two billion thunder bolts streak from the sky each year, the equivalent of 50 per second. Despite this continuous lightning bombardment, protective devices such as lightning arrestors are able to detour thunder bolts into the ground and prevent even temporary interruption of electric service.

"Power lines are shielded against lightning strokes by placing grounded wires above them to guide thunder bolts harmlessly to earth. High current surges produced by lightning striking power wires are also directed to the ground by de-ion protector tubes on transmission lines and on such equipment as transformers. The power line's normal current is prevented from following to the ground by gases in the tube."

Dr. McCann described as recording "eyes" 10 battery-operated cameras which have been attached to fire towers in Western Pennsylvania to measure the amount of current in strokes of lightning, the number of separate streaks in one thunder bolt and their duration. When lightning strikes a fire tower mast and jumps a half-inch gap in the camera, resulting flash is recorded by a film on a revolving disk.

Lightning Strokes Recorded

Atop the 535-foot University of Pittsburgh Cathedral of Learning the Westinghouse lightning investigators have installed a device known as a fulchronograph which measures the amount of current and the duration of lightning hitting the top of the building. This instrument was developed by Charles F. Wagner, manager of the company's Central Station Engineering Department, and Dr. McCann. Two lightning hits were recorded by this fulchronograph in 1941, three in 1940, and three in 1939.

D. C. Prince, President of the American Institute of Electrical Engineers.

Another fulchronograph, placed on a 585-foot smelter stack of the Anaconda Copper Mining Company at Butte, Montana, recorded last summer the most powerful stroke of lightning ever recorded. The total amount of current in this one stroke exceeded 160,000 amperes of electricity and the estimated pressure was 15,000,000 volts. Fulchronograph records disclosed that another bolt striking the shaft consisted of 22 separate strokes.

The lightning recording mechanism of the fulchronograph, enclosed in a metal case about 18 inches square, consists principally of an electric motor and a slotted aluminum wheel. The rim of the wheel is filled with small strips of magnet steel projecting like fins and rotating through two coils. The coils carry current from the lightning stroke being measured. Current in the coils produces a magnetic field which is proportional to the surge of lightning current. The steel fin on the recording wheel which happens to be passing the coils at a given instant is magnetized in proportion to the amount of current carried by the stroke, in time divisions as brief as 40 millionths of a second. Characteristics of the stroke may be determined by the number of fins magnetized, and the degree of magnetization.

The first technical session of the meeting was held Thursday morning, December 4, with B. P. Babin, chairman of the New Orleans Section, AIEE, presiding.

A comprehensive description of the rectifier installation in the Alcoa, Tenn., plant of the Alumi-

Left to right: (1) J. T. Logan, Georgia Power Co., Atlanta; A. C. Morrison, Duke Power Co., Charlotte; and J. H. Miles, Georgia Power Co., Atlanta. (2) J. S. Morgan, Knoxville, and C. L. Crosby, Richmond, both of Allis Chalmers Co. (3) R. M. Bush, Va. Elec. & Power Co., Richmond; C. W. Schweres, Allis Chalmers Co., New Orleans; and L. W. Long, also of Allis Chalmers Co., Pittsburgh.

Left to right: (1) C. W. Ricker, of Tulane Univ.; H. B. Duling, Georgia School of Tech.; and L. M. Keever, N. C. State College. (2) Otto Jensen, ITE Circuit Breaker Co., Philadelphia; and F. J. Stevens, American Lava Corp., Chattanooga. (3) E. B. Mabson, La. Power & Light Co., New Orleans; J. E. Housley, Aluminum Co., of America, and vice president of Southern District AIEE; and C. B. Norris, Tulane University.

num Company of America was presented jointly by J. Elmer Housley, of Alcoa, and H. Winograd, of Allis-Chalmers Mfg. Co., of Milwaukee. Included was a discussion of the power circuits, the rectifier equipment and layout, the cooling system, excitation and grid control, protective equipment, switchboards, load control and phase multiplication method.

Of particular interest was the comprehensive program of preventive maintenance which has proved to be an important factor in minimizing power interruptions resulting from equipment failures.

"One feature of this program," the authors reported, "is the regular testing of the power factor of insulation. Each major item of equipment, including transformers, oil circuit breakers and bushings, is tested when installed or overhauled and annually thereafter. Any indication of faulty insulation is investigated immediately and corrected. Failures have been averted by correcting faulty conditions in the initial state. The problem of transformer maintenance has been simplified by close attention to oil. Activated alumina by-pass treaters are used for the treating of bushing oil. Activated alumina breathers have been successful in excluding air-borne moisture from transformers, thereby maintaining a high dielectric property of the oil."

Dr. G. D. McCann, of Westinghouse, who discussed effects of lightning.

Other papers presented at the first technical session included "Automatic Dimming Automobile Headlights," by Lieutenant-Commander Thomas F. Ball, of U. S. Naval Academy; "Formulas for the Inductance of Rectangular Tubular Conductors," by Thomas J. Higgins, of Tulane University, and the paper describing electrical design of TVA hydroelectric stations, mentioned previously.

The concluding technical session, held Friday, December 5, with Mr. Babin again presiding, opened with the paper on carrier-current relaying and communication by Messrs. Talmadge and Merritt. J. T. Logan and J. H. Miles followed them on the program, discussing features of their paper on high-speed switching. The authors pointed out that the quality of electric service as reflected through variations in motor speeds resulting principally from voltage surges is about as important to many manufacturing processes as is the continuity of such service. They explained the effects of voltage surges on an extremely speed-sensitive manufacturing process and described how the effect can be minimized to the extent of becoming harmless. The paper establishes the maximum tolerable driving motor speed variation that will not result in impairment of the product and describes means for preventing a greater variation irrespective of voltage surge in-

Left to right: (1) E. H. Bailey, General Electric Co., Atlanta; and P. B. Boyd, Georgia Power Co., Atlanta. (2) W. J. Googe, D. D. Murphree, and S. M. Sharp, all of Southwestern Gas & Elec. Co., Shreveport, La. (3) B. H. McCoin and L. W. Marshall, both of Knoxville Electric Power Board.

tensity. The authors also described an alarm system which is capable of instantly responding when variations in speed exceed tolerable limits.

A study of low voltage underground networks was presented by P. B. Boyd, of Georgia Power Co., who concluded with a forecast of the changes in design which present trends indicate:

"The installation of non-leaded secondary cable will undoubtedly become standard construction," Mr. Boyd told the meeting, "except for a few cases as in paper insulated lead covered network where it is necessary to install an additional set or replace a set in the existing network area. The installation of limiters will also become more universal, especially on new construction where non-leaded cable is installed. The limiters even on leaded installation will in time completely replace the fused junction box.

"The installation of non-inflammable liquid insulated transformers will become general for subway installations as the price differential between oil insulated and non-inflammable liquid insulated transformers becomes less. For non-submersible installations, especially in buildings, the dry type air cooled transformer will be preferred.

"For the installations of oil insulated transformers, built-in fixtures of a fire extinguishing system made adaptable to connect to portable fire extinguishing equipment will find favor. The installation of an a-c network supervisory system will undoubtedly be found desirable for many systems, especially those using oil insulated transformers where some means for providing for temperature and pressure control of the transformers to indicate faults in their incipiency is desired. Such a system would also show the positions of all network protectors, both closed and opened and would thus reduce time necessary to perform switching operations."

Following the presentation of papers by F. M. Starr and Frank J. Stevens, mentioned previously, the meeting was addressed by D. C. Prince, vice-president of the General Electric Co., and national president of the American Institute of Electrical Engineers.

"Post-War Problems of Industry" was the subject of Mr. Prince's address, which anticipated the conditions which will probably confront American industry at the end of 1943 and the measures that may serve to avoid disturbing economic displacements.

Protecting Transmission Lines Against Lightning

By K. B. McEachron

GENERAL ELECTRIC engineers have found in their studies of lightning discharges to the Empire State Building that lightning consists of high current peaks which are often superimposed on a fundamental low current discharge. The high current peaks may be of the order of several thousand amperes—Lewis and Foust having shown that current peaks as high as 200,000 amperes may occur, though infrequently. These values refer to the stroke currents which, in general, when found in transmission and distribution circuits as the result of direct strokes, have a smaller magnitude on account of the presence of other current carrying paths. The low or continuing value between peaks may be as small as ten amperes, and persist on the average of about 0.4 second. This low current is probably responsible for most of the fires started by lightning.

It has been shown also that streamers will form from objects on the ground to be struck in advance of actual contact, and this may be the reason some types of trees seem to be struck in preference to others—streamers form from them more readily, thus increasing, in effect, the electrical height of the tree.

Studies of the effects of many strokes indicate clearly the necessity of keeping the ground resistance of protective arrangements as low as possible. This is true whether it be lightning rods on a home or ground wires over a transmission line. The area of involvement as well as the severity of the effects are reduced as the ground resistances are reduced. These studies also emphasize again the desirability of interconnection of grounds within a structure to avoid high voltages between them, if either one has to carry lightning currents.

Dr. K. B. McEachron, in lightning laboratory at G-E Pittsfield Works, photographing flash of lightning.

The overhead ground wire continues to be the most universally used means of keeping transmission lines from flashing over due to lightning. Experience seems to show that, if the conductors are kept within a 45 degree vertical angle at the ground wire, (1:1 protective cone) good shielding may be expected. However, still better performance will result with a smaller angle, although some lines are operating with a larger angle.

Tower footing resistance may be reduced by the use of vertical ground rods or through the use of the buried counterpoise. Lewis and Foust, with the cooperation of various power companies, are investigating the performance of these two types of grounding under natural lightning conditions. Ground resistances, of the general order of 10 to 20 ohms, are indicated for reasonable lightning performance. In general, as the spans become shorter, or as the insulation in a given case is increased, a higher ground resistance can be tolerated.

In those cases where it is difficult to economically justify the overhead ground wire, the protector tube may be used, since with its use the ground resistance may be high. The protection offered by the tube is positive, since it is directly in shunt with the insulator string. It is necessary only to so arrange things that sufficient power current will flow, following the passage of lightning through the tube, to be certain that sufficient pressure is developed within the tube to properly extinguish the follow current.

System interruptions, due to insulator flashover from other causes as well as lightning, may be prevented on systems operating non-grounded, by the use of the ground fault neutralizer. This device, installed at appropriate points between neutral and ground, operates to reduce the current at the fault, so long as it is only a single line fault to ground, to such a value that it quickly extinguishes itself.

NEWS of the INDUSTRY
National and Southern

Smaller Electrical Appliance Lines Are Presented to Dealers for 1942

Frigidaire Announces 1942 Standard Models

New 1942 Standard Model Frigidaire refrigerators have been announced by E. G. Biechler, general manager, Frigidaire Division, General Motors Corporation.

In announcing these new models, Mr. Biechler emphasized that America's war needs naturally have first call upon Frigidaire resources. "Frigidaire is turning out machine guns and other armaments in ever-increasing quantities," he said, "and we are sparing no effort to further expand our defense activities."

"At the same time, we are going to do everything in our power to provide the Frigidaire dealer organization with all possible new products of highest quality—and, to help keep products in customers homes operating efficiently."

According to P. M. Bratten, Frigidaire general sales manager, the new Standard Models are available in three groups to meet different customer demands. "Food storage capacities are larger than in comparable 1941 models," he said, "and other new features include convertible interiors to accommodate foods of different shapes and sizes, a new combination Meat Tender, and Cold Storage Tray."

The new Standard Model S 7-42 retains all the important features of the lowest priced 1941 Frigidaire model, the LS-6, but has a full 7 cubic foot food compartment. The cabinet chassis itself is also larger, and exterior styling changes have contributed to a more pleasing appearance.

"The new M 7-42 is available with extra utility features including a new drawer type Meat Tender, which is considerably deeper than Meat Tenders of former years, with a new combination Cold Storage and Defroster Tray which makes it unnecessary to remove meats from the Meat Tender when defrosting. In addition, this model has a sliding glass topped Hydrator and several appearance advantages over the S-7. It is available with an exterior finish of either Dulux or Lifetime Porcelain.

"To meet the demand for an even more completely equipped standard type refrigerator, there is a new D 7-42. A particularly noteworthy feature of this model is its 12 way convertible interior which permits a choice of 12 different interior arrangements of the shelves, to suit any family's particular needs at any season of the year. Besides having all the advantages of the M-7, this new Frigidaire also has a utility storage bin for keeping foods that do not require refrigeration.

The D-7 is also available with an exterior finish of Lifetime Porcelain and with an extra hydrator which can be operated as an easy sliding drawer when it is placed either beside or above the other hydrator.

In addition, to meet a definite demand for a larger capacity standard refrigerator of this type, there is a 9.1 cubic foot model finished in Dulux. This model has the same equipment as the D-7, except that the frozen storage compartment, Meat Tender, Hydrator and Utility Storage Bin are all larger — there is an extra Hydrator which slides as a drawer in either of two positions, and there are two additional ice trays.

Other features of these new 1942 models include streamlined door construction, and concealed door trim screws, improved corner mounting of door seal, eye level location of the Cold Control and new rubber cushion shelf mounting.

Like the food storage space of this new 9 cu. ft. standard model Frigidaire, its new Meat-Tender has larger capacity and great utility. Chief Engineer S. M. Schweller is demonstrating the advantages of this new feature to E. R. Godfrey, assistant general manager, P. M. Bratten, general sales manager, and L. A. Clark, advertising and sales planning manager.

Gibson Line Presented At Distributor Meeting

The 1942 line of the Gibson Electric Refrigerator Corporation of Greenville, Michigan, consisting of five instead of last year's eight models, was presented at a two-day national distributors' convention in Grand Rapids, Mich. With production curtailed for 1942, its advice to dealers was to emphasize sales in the

higher income consumer groups in order to preserve dollar volume.

Gibson executives also emphasized that the company did not favor, nor had it effected, the establishment of higher prices from inflating the prices of the lower models in the line. Instead, distributors and dealers were encouraged to feature refrigerators of high quality which performed extra services for the users and thereby justified higher prices.

The equivalent of Model No. C-631 of last year is eliminated from the line this year, and the 1942 line starts with the equivalent of the second model of last year, and is the No. CU-632 with a suggested list price of $139.95. The other four models, with their suggested list prices, are as follows: No. F-662, $174.95; No. F-682, $199.95; No. F-682, $219.95, and No. SF-792, $259.95.

It was said that the Gibson policy considered that the low-priced leader, as it has for the past few years been featured throughout the industry, is not essential to this year's merchandising program because volume cannot be the price objective under the curtailment program.

The Gibson electric range line will consist of three instead of four models as of the last year. The suggested list prices of the models are as follows: No. ER-932-SV, $119.95; No. ER-392-RV, $189.95, and No. ER-392-TV, $249.95.

The merchandising program for 1942, for consumer advertising, consists of a continuation of the Gibson-Paid newspaper advertising program, standard cooperative advertising and an eight-month's schedule in Life magazine.

"Night-Watch" Top Feature Of 1942 Norge Refrigerators

New beauty achieved through streamline design of both exteriors and interiors and a host of sales-compelling exclusive features distinguish the 1942 Quiet-Flo Rollator Refrigerator line of Norge Division, Borg-Warner Corporation.

Seven models, two six-foot, three seven-foot, including an all-porcelain model, and two nine-foot sizes, offer a wide range in prices and features which enable the dealer to appeal to all classes of prospects while holding his stock to reasonable minimums, a point which is likely to be increasingly important during this year of the all-out victory campaign.

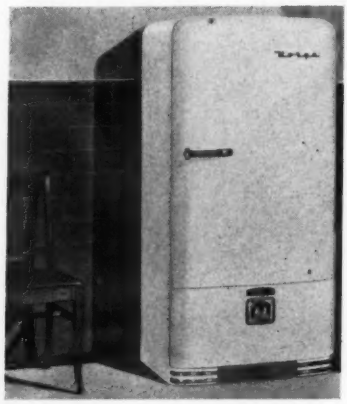
Outstanding among the exclusive Norge features will be the Night-Watch fully automatic defroster, which, since its introduction last year, was found not only a potent force in clinching sales above the minimum price class but an excellent drawing card for the entire line. The Night-Watch electric clock, controlling the

Convenience and economy are virtues of the bigger, deeper, new Norge Coldpack. It permits larger, lower-cost purchases of meat at one buying. Added attraction is the fact that Coldpack is never used for a defrost drip catcher.

action, automatically defrosts the freezer unit for three hours each night, between midnight and 3 a. m.

Not an accessory, but an integral part of Norge design, the Night-Watch defrosting system will take a particularly important place this year because its action in regularly and systematically defrosting the Freezer makes for efficient operation, a point stressed in a recent Government defense bulletin.

Night-Watch defrosting requires no attention from the housewife excepting at weekly intervals when accumulated defrost moisture is emptied from the hard-to-spill, pitcher-like Handefroster. It is practicable only in Norge because of the Norge covered Coldpack construction, which eiminates use of the cold meat drawer as a defrosting tray. A shallow defroster tray, suspended under the bottom of the freezer unit, carries defrost moisture directly to the Handefroster. Covered Coldpack, Handefroster and defrost tray, functioning together, thus avoid the necessity of moving food during defrosting.



Careful attention to detail has given the new 1942 Norge Quiet-Flo Rollator Refrigerator a streamline design of complete harmony.

The exclusive Norge Safety-Sealed Fast Freezer prevents accumulation of frost in that unit and allows the Night-Watch defrosting action to take place without allowing defrost water to drip into ice trays. Thus it is apparent that Night-Watch automatic defrosting is a fundamental of Norge design and not merely an automatic clock placed in circuit with the Coldmaker.

One of the most useful and interesting features of the 1942 Norge is the new base leveller which allows the unit to be levelled off perfectly despite irregularities of the floor on which it may be placed. The leveller is operated quickly and easily by anyone. With absolutely level floors the exception, even in brand new houses, this device will be appreciated by housewives who have previously been bothered by refrigerator doors swinging either shut or open while they are busy removing or placing food.

Eye-appeal, that potent sales force which brings the window-gazing prospect into the store and which has so long been a major consideration to the American woman, is one of the outstanding merits of the new Norge. Inside and out, stream-line design has reached new heights, produced a unit whose beauty is compelling.

Clever use of plastics has gone far to create the new effects. The flowing lines of the Norge nameplate, executed in antique-gold shade of a new and sturdy plastic, sets off the gleaming white Norgloss finish. The same shade is used on the plastic Lazilatch door-opener, the handle of the large dry-storage bin and the trim-band and clock face of the Night-Watch.

Functional improvement has gone hand-in-hand with design. The covered Coldpack is in crystal glass for new beauty, has been made larger to provide greater storage space. Increase in capacity has been provided in the Safety-Sealed Freezer, too, to accommodate larger supplies of frozen foods, desserts, etc.

Seven New Models Shown In 1942 Crosley Line

Crosley has taken a long look ahead in designing and engineering its new 1942 line of refrigerators, which were introduced to Crosley distributors at a series of two-day sales conferences.

"Recognizing that national defense needs must come first, Crosley designers and engineers have given careful consideration to the selection of materials that we may reasonably expect will be available for some time to come, so that the quality of the Crosley line will continue at its

UNIVERSAL *presents* THE NEW *MERCURY* RANGES

. . . *with* "NUTRITIVE COOKING" for National Good Health!

Universal's new Mercury line of Electric Ranges for 1942 features "Nutritive Cooking"—cooking that results in more nutritious meals prepared easier in less time and at lower current costs.

To sell more Universal Ranges in '42, tell your customers how "Nutritive Cooking" seals the vitamins in the food. Tell how it conserves time for war work through automatic control. Tell how it conserves electricity through accurate, flexible control. Show how these things aid good health and national defense. Wire or write for complete information.

UNIVERSAL offers "NUTRITIVE COOKING"
with these selling features that save vitamins, time and electricity
1 Mult-I-Heat Controls with Signalite Indicators.
2 Select-A-Trol.
3 Superheat Units.
4 Economy Cooker.
5 Bake-Fast Oven.

Universal

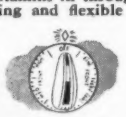
FEATURES GIVE MAXIMUM NUTRITION

War Makes Vitamins More Vital

Research workers have long emphasized the importance of sealing vitamins into food. And now, during the national emergency, is the time to turn their findings into action!

Mercury Ranges Meet the Challenge!

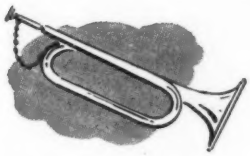
After years of testing in laboratory and kitchen, special Universal Mercury Range features now aid in sealing the vitamins in through waterless cooking and flexible controls.



Designed for Low Cost Meals

Mult-I-Heat Control, the Bake-Fast Oven and the Economy Cooker all contribute to the preparation of nourishing low cost meals—particularly desirable in time of rising costs and the need for extra nourishment.

NEWS FOR UNIVERSAL DEALERS!

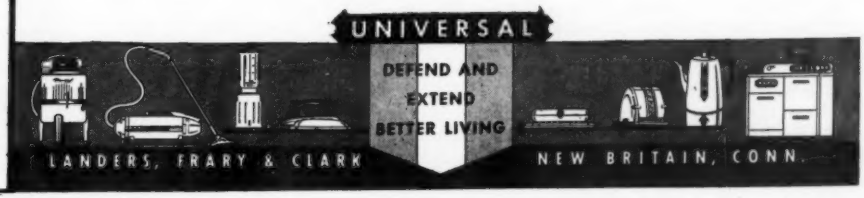


Universal Answers the Call

Universal is cooperating wholeheartedly in the war program, but Universal is not losing sight of its responsibility to extend better living for consumers and dealers. After Government orders have been filled, everything humanly possible will be done to rush merchandise on the established pro rata allotment plan.

No Substitute for Universal Performance

If at any time in the opinion of our engineers, Universal appliances would fall below Universal performance standards by virtue of the use of alternate materials, such items will be withdrawn from our lines. The production of all items that do meet our standards is being maintained at a maximum peak within the limits of our capacity.



high level," said R. I. Petrie, vice-president and general sales manager, The Crosley Corporation, in announcing the new line.

J. F. Crossin, manager, refrigeration division, pointed out that the resourcefulness of Crosley engineers and designers, together with exhaustive research into sources of material supply, had made it possible to incorporate important improvements into the new Crosley refrigerator line.

The new Crosley models are larger and more massive than previous refrigerators and glass shelves are now standard equipment throughout the line, Mr. Crossin said.

Seven new models are included in the 1942 Crosley refrigerator line—one six-foot model, four seven-foot models, and two nine-foot models. Each one features the patented Crosley Shelvador.

R. C. Cosgrove, vice president and general manager of the Crosley Corporation (at right) and R. I. Petrie, vice president and general sales manager, have been examining one of the first models of the new 1942 Crosley refrigerator line.

"Twice as much food to the front within easy reach," continues to be the theme of the Crosley refrigerator line, as it best expresses the outstanding and exclusive feature which distinguishes a Crosley refrigerator from any other make.

Hotpoint Ranges Feature Fundamental Improvements

The successful efforts of Hotpoint retailers during 1941, which again put Hotpoint far ahead in electric range sales, together with Hotpoint's foresighted engineering and manufacturing policies, will assure Hotpoint retailers of the greatest possible share of 1942 electric range business, according to Ward Schafer, manager, Hotpoint Range Sales Division.

In a statement to Hotpoint retailers, Mr. Schafer said, "We will manufacture Hotpoint electric ranges in 1942, under the government's production allocation policy, based on a percentage of previous business. Because of Hotpoint's leadership, Hotpoint retailers will have a substantial share of available electric range production in 1942.

"Moreover, Hotpoint is cooperating fully with war production. A scarcity of materials for production tools to manufacture radically changed designs could seriously delay production. Therefore, to release as many of these materials as possible for defense, and to assure steady production, 1942 Hotpoint range models are basically unchanged, except for whatever material changes have been incorporated due to the metal requirements of defense industries. These ranges retain the same fundamental features which sold Hotpoint ranges in greater total quantity during 1941 than any other brand."

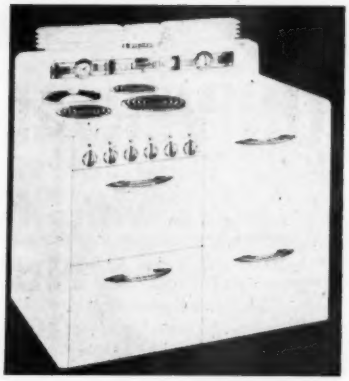
Mr. Schafer continued, "Our Government agrees that the cook stove is a necessity for continuance of our way of life. This year, more than ever before, the fundamental features of electric cooking give prospects compelling motives for buying electric stoves. These features were pioneered by Hotpoint engineers, and have been perfected to their ultimate degree in today's Hotpoint electric ranges. Among the outstanding exclusive features are what we might term Hotpoint's "Big Four," namely: the famous Hotpoint Calrod units, the over-size Thrift Cooker, the Flavor-Seal oven, and the automatic electric timing clock."

Shown in the illustration is Hotpoint's Masterpiece Range, including every fundamental Hotpoint feature, which typifies the Hotpoint range line for 1942.

Made with Hotpoint's famous battleship construction, it is finished in gleaming white porcelain. Two Venetia-type lamps and twin condiment ment jars add beauty and utility to the massive backsplasher. Illuminated switch dials of clear plastic indicate when any unit is on. Handsome metal unit locators are mounted above each switch. This range has one giant and two utility-size Hi-Speed Calrod units with five measured heats, for all types of surface cooking.

The seven-quart porcelain enamel Thrift Cooker, so useful in preparing economical meals, has a handsome metal alloy lid. The over-size Flavor-Seal oven with balanced heat provides exactly the right amount and distribution of heat for any baking, roasting, or broiling operation. In the Hotpoint range oven, heat is balanced and distributed from all directions within the oven, according to the oven heat selected for a particular operation.

A handsome white combination roasting and broiling pan and an adjustable meat rack are standard equipment in this range.



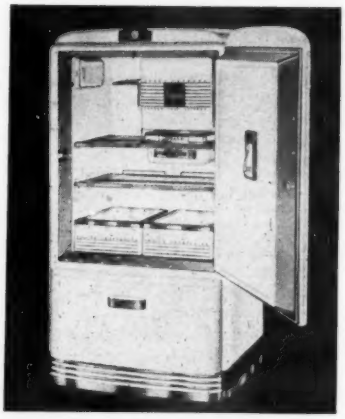
The Masterpiece Range features all of Hotpoint's "Big Four" features: Calrod units, over-size Thrift Cooker, Flavor-Seal Oven, and automatic timing clock.

There are two utility drawers. One has a built-in warming unit for keeping plates or food at serving temperature. This drawer contains a removable plate rack which allows air to circulate around the plates, warming them more rapidly.

Also standard on the Hotpoint Masterpiece Range are the built-in Timemaster and Timemeasure. These two features are outstandingly useful during these busy days when homemakers need extra time for the additional duties imposed by the nation's needs.

Models in the current Hotpoint refrigerator line include the 6 cu. ft. Special (EA63); the 7 cu. ft. Doric (EA7); the Special Doric (EAS7); the 7 cu. ft. Standard Doric, in either Calgloss or porcelain finish (EB7-42 or EBP7-42); the 7 cu. ft. DeLuxe Doric (EC7); the 8 cu. ft. DeLuxe and Imperial Tudors (EC8 and ED8); the 12 cu. ft. Imperial Empire (ED12), the 16 cu. ft. Imperial American (ED16), and a Special 6 cu. ft. model.

The Hotpoint 7-cubic-foot DeLuxe



Hotpoint's 7 cu. ft. Deluxe Doric featuring the Easy Clean porcelain enamel Speed Freezer.

CONSERVE RUBBER

GENERAL CABLE

GENERAL CABLE

Use PAPER or VARNISHED CAMBRIC

Serve the Nation's interests by conservation of all vital materials. Rubber is extremely vital to all branches of the Service.

GENERAL CABLE CORPORATION

Doric, and the 8-cubic-foot DeLuxe and Imperial Tudor Refrigerator include every new Hotpoint convenience feature. On these models the Easy Clean porcelain enamel Speed Freezer is located at the right. The Speed Freezer door is steel finished in porcelain enamel with an over-center spring to hold the door open. It carries a handsome nameplate of translucent plastic. In these two models, the freezer holds ice trays with 80-cube total capacity, and a ½-gallon dessert tray. The Defrost Indicator at the side of the Speed Freezer shows when defrosting is necessary.

The 16-point constant temperature control is conveniently located in the top front of the cabinet.

The famous Hotpoint Butter Conditioner, introduced last year, is located on the left wall above the top shelf. It holds one pound and is thermostatically controlled to keep butter at the proper spreading consistency.

The Six-Way Cold Storage Compartment beneath the Speed Freezer may be used in six different positions for various storage requirements. It consists of a glass tray and porcelain enamel meat pan with Measured Humidity.

Two Hi-Humidity Storage Drawers with glass tops are standard in these models. Here fruits and vegetables may be kept at the peak of freshness. Shelf equipment includes one gliding and adjustable tray shelf; two split shelves, and one top part shelf.

Universal Appliances Shown in Chicago Show

What promises to be an outstanding show will take place in January at Chicago when Landers, Frary & Clark, manufacturers of Universal products, will present their electrical and hardware appliances designed for "better living" at the annual House Wares Show to be held at the Palmer House.

Two exhibits, one featuring such major appliances as the Universal "Wash White" washers, "Tattle Tale" cleaners and Mercury ranges; and the other displaying small appliances such as Coffeematic, Glider Iron, Mag-nif-eye scales and Crystalite, the attractive new cutlery will be the eye catchers of the show.

In the major appliance field, Universal will present their Tattle Tale tank type cleaner with its cleaner attachments, wands and hose in one big splurge of two-tone blue and the economy model sporting a beige and green combination. In both models the glistening Polymeroid finish is a distinct contrast to the soft moire finish.

The Tattle Tale light, toe switch, handy storage kit, floor polishing attachment, and twelve other attachments will be featured in these models made even more efficient by their oil-less ball bearing motor. Both models feature the patented thread-picking, non-dragging, non-sealing super intake carpet nozzle and the whirlwind super suction created by Universal's triple turbine type fans.

"Defend and Extend Better Living" is the keynote of Universal's 1942 sales plans just being announced to Landers, Frary & Clark distributors. Harry Parsons, left, sales manager of the range division at the Universal plant, discusses the economy cooker of the 1942 range with Lynne Fox, home economist, while Ed Powers, Bill Cashman and Hardy Payor listen attentively.

In addition to the Tattle Tale cleaners, Universal will show the Mercury model ranges which are directed towards new speed, convenience and greater economy and are the nation's fastest range by test. These Universal ranges offer the famous features of (1) Multi-heat control which revolutionalizes top burner cooking and permits one to dial any heat desired; (2) Automatic oven control; (3) Select-a-trol that allows the selection of time control for adjustment to any one task, either in the new cooker or at the convenience outlet; (4) Automaticook and Minit-minder which act as a chef and turn the oven off in the housewife's absence.

The leading player in Universal's line-up of Wash White washers will be the deluxe nine-pound model sporting several unique features including a Time-a-matic switch that automatically shuts off the current when the washing is finished and that times any period from one to fifteen minutes and which is marked for proper washing time for different fabrics including everything from curtains to overalls; an Overload Protecto-switch that instantly shuts off the motor in case of strain, overload or stalled wringer; a Roll-pressure indicator that assures the right pressure for every fabric and completely eliminates wringer clogging; and a pair of new wind-away cord hooks that prevent tripping and broken plug replacements. In addition to these new features, Universal washers have all porcelain white tubs, non-clog strainers, power electric rolls, protected feeding zones; floating power, and one push reset levers, and that this line is supported by a complete line of Spinners, Gas engine models and Ironers.

To add to the convenience and comfort of washday Universal's "Cool Grip" Glider Iron . . . the new lightweight, streamlined iron with its exclusive air ports which protect the hand from rising heat will have an honored place in the exhibition. Designed to make ironing easier, the air-cooled Glider with its smooth bakelite handle has a grip that eliminates fatigue. The round heel prevents the wrinkling of fabrics on the backstroke and the beveled point allows the iron to move smoothly under buttons . . . the finger-tip control gives accurate heat adjustment for every fabric.

Six Refrigerator Models In Kelvinator 1942 Line

Big news from Kelvinator, which is now announcing its 1942 models, designed some time ago, is the large size of their 1942 refrigerators. The new models will include four seven and two nine cubic foot sizes. Other news is that the sparkling glass-shelved, high-humidity refrigerators pioneered by Kelvinator have been further improved and beautified.

Hotpoint Leadership Again Demonstrates Its Value to Retailers

THE ARISTOCRAT, *replica of Hotpoint's Millionth Range which set the standard of quality for 1942 models.*

AS leaders in the Electric Range industry, Hotpoint again bears the standard of dependable quality by announcing a continuation of the features and manufacturing policies which made 1941 the greatest year in Electric Range history.

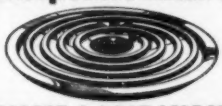
In order to cooperate with our country's war effort in the conservation of machine tools, manpower and precious materials, we shall, until further notice, follow the policy of constantly improving the line without introducing yearly models.

Hotpoint's plans for 1942 include a program to strengthen the position of Hotpoint and its retailers through new strategy in its advertising and sales promotion. This embodies novel and effective ideas keyed to the current conditions. Headed by a new National Advertising campaign reaching 25 millions of families with a timely appeal and supported by the great new movie "Sauce For The Gander," Hotpoint retailers will find ample activities to fortify their positions and keep sales rolling. Get in touch with your distributor today and learn the whole Hotpoint program for 1942. Edison General Electric Appliance Co., Inc., 5614 W. Taylor St., Chicago, Ill.

Hotpoint Advertising and Sales Promotion for 1942 Employ New Ideas

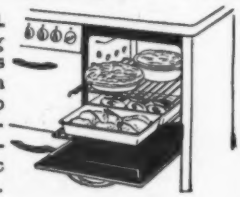
HOTPOINT'S reputation for being out in front with new advertising and sales promotion slants to fit changing conditions is typified in plans for 1942. A big National Campaign in magazines with mass coverage, timely copy themes, and, of course, the new "Sauce for The Gander" movie program patterned after Hotpoint's sensationally successful "Blame It On Love" plan.

Hotpoint Features of Proved Quality for 1942



SELECT-A-HEAT CALROD units with 5 Measured Heats for 1942 embody the same quality and features that made Calrod famous.

FLAVOR-SEAL OVEN. Heating units in top as well as bottom of oven keep heat "in balance"—an exclusive electric range feature.



HOTPOINT AUTOMATIC TIMER CLOCK enables women to spend time in patriotic work outside the kitchen without neglecting meals.

THRIFT COOKER converts low cost meats and tasty economy foods into healthful, delicious meals. Conserves electricity, too.

Visit Hotpoint Showrooms, 528 Furniture Mart, Chicago, January 5 to 17

Hotpoint ELECTRIC RANGES

RUBBER COVERED POWER CABLES • BUILDING WIRE • VARNISHED CAMBRIC • FLEXIBLE CORDS • LEAD-ENCASED AND PARKWAY CABLES • ARMORED CABLE • CRESFLEX NON-METALLIC SHEATHED CABLE • SERVICE ENTRANCE CABLE • MAGNET WIRE • BARE WIRE

A Tough Cable For Tough Jobs!

CRESCENT IMPERIAL WELDING CABLE

The enormous increase in welding required for the manufacture of ships, tanks and other defense items is being met by the use of CRESCENT Imperial Welding Cable.

This cable is of the highest quality, as is the complete line of wires and cables made by CRESCENT.

CRESCENT INSULATED WIRE & CABLE CO.

CRESCENT WIRE and CABLE

Factory: TRENTON, N. J.—*Stocks in Principal Cities*

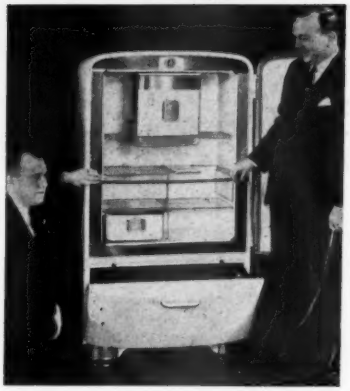
SOUTHERN REPRESENTATIVES

ATLANTA, GA. — Edgar E. Dawes, A-4 Rhodes Bldg. Annex

NEW ORLEANS, LA. — Paul Hogan, Jr., 823 Perdido St.

DALLAS, TEXAS — Huie-Simmer Co., 103 Thomas Bldg.

CRESCENT ENDURITE SUPER-AGING INSULATION



With a tape measure Frank R. Pierce (right) vice president in charge of sales of Nash-Kelvinator Corporation, and Charles T. Lawson, general sales manager of the Kelvinator Division of the corporation, call attention to the size of the 1942 Kelvinator models.

Prices of the new models, it was revealed by Frank R. Pierce, vice-president in charge of sales, will run from $149.95 for the lowest-priced seven cubic foot model to $259.95 for the big nine cubic foot "Moist-Master." He pointed out that despite the fact that the new Kelvinators have more features, more storage room, and more value in every respect — and despite increased costs and production restrictions — Kelvinator prices for 1942 are actually as much as $30 below the level that existed in 1939 before the company's new program startled the industry and skyrocketed Kelvinator sales to record levels.

The streamlined distribution and manufacturing policy established by Kelvinator then is being followed as closely in the 1942 program as conditions permit, Charles T. Lawson, general sales manager of the Kelvinator division, said.

There are two "Moist-Master" models in the 1942 Kelvinator line, a seven and a nine cubic foot model, and they have been designed for greater efficiency so that they do an even better job of helping to protect the family health, and minimize losses from food spoilage. The "Moist-Masters" supply five different kinds of cold to provide for exactly the right temperature and humidity for each kind of food to keep the various foods in perfect condition.

First, there is the freezing compartment with below-freezing temperatures for making ice cubes, for quick chilling, and for the storage of frozen foods and ice cream.

Second, there is the Meat Chest with its near-freezing temperatures for the storage of fresh meats and game.

Third, there is the necessary dry cold area on the shelves to the right

and left of the freezing compartment. This is ideal for milk, cream, beverage and canned or bottled foods.

Fourth, is the moderately moist area just below the dry cold area. Here is the correct storage place for foods with protective coverings, such as dairy products, citrus fruits and even berries.

Fifth, is the super-moist cold area completely enclosed in clear glass. Here air circulation is reduced to a minimum and fresh fruits, vegetables, unused portions of opened canned goods, and uncovered "leftovers" find a perfect haven, and are kept fresh and appetizing for days longer.

Foundation block of the new glamour refrigerator is the mechanical unit, which Kelvinator calls the polarsphere. It is a hermetically sealed unit—a mechanism which operates beneath a sealed steel dome. It has no fans, belts or pulleys and, Mr. Lawson declares, has a better mechanical record than the finest watch. For example, the service record kept by the factory on this unit since its perfection shows that it is 99.50 per cent satisfactory, indicating that less than ½ of 1 per cent have been returned to the factory for service.

New OPM Order Affects Maintenance and Repair

A new order which helps many thousands of manufacturers and producing plants to obtain repair, maintenance and operating supplies, and will benefit many electrical contractors, motor shops, appliance service organizations, and electrical supply houses has been announced by the OPM Division of Priorities.

The new order is known as Preference Rating Order P-100. It takes the place of the old Repair and Maintenance Order, P-22, which is being revoked.

Main purpose of the new order, as was the case with the old, is to extend priority assistance to manufacturers and producers so that they can keep their plants and production machinery in good running order.

The differences between P-100 and P-22 are largely technical. However, some provisions of the old plan have been liberalized and a number of clarifications have been made in order to eliminate misunderstandings and misapplications of the order which occurred in the past.

The assistance granted by the order is not available for retail operations. It is available, however, to the following:

(1) Any governmental unit;

(2) Any individual, partnership, association, corporation or other form of enterprise engaged in one or more of the following capacities to the extent that it is so engaged or so acts: (a) manufacturing, processing or fabricating; (b) warehousing—maintaining warehouses for storage or distribution of any material; (c) wholesaling — acting as a distributor of products sold to manufacturers, wholesalers, retailers or other persons not consumers; (d) charitable institutions—any charitable or eleemosynary institution which is recognized as such for purposes of the Internal Revenue Laws of the United States; (e) carriers—urban, suburban, and interurban common or contract carriers of passengers or freight by electric railway, electric coach, motor truck or bus, including terminals of any of the foregoing; railroads, including terminals; shipping—commercial carriers of freight and passengers by ocean, lake, river or canal, including terminals; (f) educational institutions (including vocational training); (g) printers and publishers; (h) radio—commercial broadcasting and communication; (i) telephone and telegraph communication, including wire services; (j) hospitals, clinics and sanitoriums; (k) petroleum and natural gas—discovery, development and depletion of pools of petroleum and associated hydrocarbons and derivatives thereof, and transportation of petroleum, associated hydrocarbons and derivatives thereof; (l) irrigation systems, whether publicly or privately owned; toll bridges and toll canals; and

(3) Any person using tools or equipment to repair or maintain the property of any producer as defined in the order.

The former restriction on acceptance of materials for inventory of maintenance, repair or operating supplies by producers using the order has been changed to permit inventory and stores not exceeding 110 per cent of the maximum dollar volume of such materials purchased during the corresponding calendar quarter of 1940. The previous figure was 100 per cent. This change has been made to allow for price increases. However, the order now specifically states that no materials may be accepted for additions to inventories and stores of maintenance, repair and operating supplies until such inventories have been reduced to a practicable working minimum.

Special attention is called to provisions of the order (in B-3) which grant priority aid to: "Any person using tools or equipment to repair or maintain the property of any producer as defined."

The above permits welding repair shops, blacksmith repair shops, small machine repair shops and other persons whose business is primarily a repair function to use this order to keep in working order their own establishments. It also permits such persons to procure the necessary tools and other items consumed in the course of their repair business.

This also applies to the acquisition of mechanics' hand and fine mechanical measuring tools when purchased by a mechanic for use in his capacity as an employee of a plant engaged in defense work. A mechanic, in order to obtain fine precision measuring tools such as micrometers, calipers

HOUSTON'S MAIN STREET ABLAZE—A striking aerial night view of the Houston, Texas new Main Street lighting system, part of a two-year safe night driving program during which the Houston Lighting and Power Company will install 3,500 street lights for that city. This system utilizes 10,000-lumen pendent type General Electric lights. Note headlight streaks along thoroughfare, denoting the density of night traffic on Main Street. To get this effect, photographer kept his camera shutter open as oncoming cars approached his lens.

and other tools of this type may sign the P-100 certification by simply stating where he is employed and manually signing his name.

Operating supplies covered by the order include files, hack saw blades, grinding wheels and any other items abraded and consumed in the operation of the business.

Parts such as gears, bushings, and other items incorporated into final products cannot be purchased under P-100. These items can be purchased, however, if the item being manufactured is a repair or maintenance item. Example: a machine manufacturer producing new equipment could not purchase gears for new equipment, but if he had to furnish a repair part including a gear this could be purchased under the order.

Tire Rationing Plan Provides For Electric Repair Services

The order issued by the Office of Price Administration during December freezing all retail tire sales resolved itself, by early January, into a strict rationing program controlling all distribution of tires. The order permits only a few tire users, essential to the public good and to armament activities, to secure tires. No allowance whatsoever has been made, for the present, for ordinary civilian consumption.

Sales of new tires will be strictly limited to individuals and agencies requiring them for the maintenance of industrial efficiency and civilian health. Included in this classification are trucks operated exclusively for plumbing, roofing, heating and electrical repair services.

Under the present rationing system, the only persons eligible to buy new tires, or who will even be considered for a purchase certificate, are those operating the following type vehicles:

1. Vehicles operated by a physician, surgeon, visiting nurse, or veterinary, used principally for professional services.
2. Ambulances.
3. Vehicles used for fire-fighting services, public police service, to enforce public health and safety laws, garbage disposal and sanitation, and mail service.
4. Vehicles with capacity of ten or more passengers, operated exclusively for transportation of passengers as part of a regular transportation system, as of students and teachers to school, and of employees to and from industrial, mining and construction projects.
5. Trucks operated exclusively for any of the preceding purposes or for transportation of ice, fuel, material and equipment for road building and maintenance, public utilities, production facilities, defense housing facilities and military establishments; transportation essential to plumbing, roofing, heating and electrical repair services; transportation by any common carriers; of waste and scrap materials; of raw materials, semi-manufactured goods and finished products, including farm products and goods, excepting transportation of commodities to the ultimate consumer.
6. Farm tractors and other farm implements other than automobiles or trucks.
7. Industrial, mining or construction equipment other than automobiles or trucks.

Progress Made in IAEI Membership Campaign

New members have been inducted into the Southern Section, International Association of Electrical Inspectors, at a rapid rate during the past month. A membership campaign begun directly after the Section's annual meeting in October has resulted in the addition of 33 new members. Members of the section credited with signing up the new members are listed below:

Boger, C. S., Charlotte, N. C.	1
Bommer, A. J., Dallas, Texas	1
Bushnell, R. O., Miami, Fla.	2
Byrum, R. L., Greensboro, N. C.	1
Campbell, R. D., Asheville, N. C.	2
Edwards, Steve, uincy, Fla.	1
Edwards, T. W., acksonville, Fla.	1
Fisher, J. C., Jackson, Miss.	5
Flynt, H. ., Winston-Salem, N. C.	1
Hancock, A. E., Austin, Texas	1
Harpster, R. L., West Palm Beach, Fla.	1
Hayes, Ray, Corpus Christi, Texas	1
ouston, O. A., Durham, N. C.	1
Jones, C. M., Atlanta, Ga.	1
Julian, L. H., Salisbury, N. C.	1
Meullier, R. W., Ft. Lauderdale, Fla.	1
Miller, G. M., Richmond, Va.	1
Peeples, Troy, Roby, Texas	1
Stall, W. A., Jacksonville, Fla.	1
Welman, Geo., New Orleans, La.	1
Whitaker, C. S., Durham, N. C.	5
Applications not endorsed	2
Total	33

Triangle Conduit and Cable Company in New Quarters

The Triangle Conduit and Cable Company, Inc., have announced that after December 29, 1941, their entire headquarters, organization and executive offices will be located at Triangle and Jersey Avenues in New Brunswick, New Jersey.

New Areas Added to Defense Housing Critical Area List

Fifteen new localities have been added to the Defense Housing Critical Areas List, it was announced in December by the Priorities Division.

The high priority ratings, available under the Defense Housing Plan, may now be applied to deliveries of specified building materials required to construct dwellings for workers engaged in war industries, and their families, in the following places: Huntsville and Tuskegee, Alabama; Helena-West Helena and Pine Bluff, Arkansas; Sterlington - Monroe - Bastrop, Louisiana; Chickasha and Muskogee-Choteau, Oklahoma, and Corsicana, Mission, McAllen - Edinburg, Terrell, Uvalde, and Waco, Texas.

For Industry . . . . and Colt Manual Motor Starters

"More business" demands industry install additional electrical controls to operate power-driven machinery with efficiency and safety.

COLT MANUAL MOTOR STARTERS are designed and constructed to meet these requirements. Note these important features:

- **The automatic relatching feature that eliminates any resetting operation of the quick-break, positive toggle mechanism.**
- **Complete starter mechanism, assembled on separate backplate, readily removed for wiring.**
- **Movable and stationary contacts easily replaced if necessary. Interchangeability of parts with other Colt Controls cuts maintenance cost.**
- **For safety, mechanism can be locked "off" without opening cover — or cover can be locked on with mechanism free to operate.**

A bank of Colt Manual Starters and Colt Safety Switches to handle additional load requirements.

DURABLE - COMPACT - ATTRACTIVE

COLT'S PATENT FIRE ARMS MFG. CO.
ELECTRICAL DIVISION
HARTFORD, CONNECTICUT

NEW GREENLEE CATALOG

TOOLS TO MAKE THE ELECTRICIANS' JOB EASIER

- HYDRAULIC CONDUIT BENDERS
- TUBE BENDERS
- KNOCKOUT TOOLS
- CABLE PULLERS
- PUSH DRILLS
- BORING TOOLS
- SPIRAL SCREW DRIVERS
- HYDRAULIC PIPE PUSHERS

Here's the new Greenlee Tool Catalog 33-E that every user of tools in construction and maintenance work should have. This handy buying guide has been compiled to make it easy to select the right tools for the job . . . tools designed to make it easier and faster for the man on the job. Write today for your free copy of this valuable reference of Greenlee Hand Tools for the electrical worker. You'll learn how these tools can help make your job easier.

Write Today for Your Copy

GREENLEE TOOL CO.

1761 Columbia Avenue • Rockford, Illinois

PERSONAL NOTES
About Men You Know

Charles T. Brasfield, of Alabama Power Company, was recently named assistant to the operating vice-president, which position he will fill in addition to his duties as service supervisor.

A native of Nachez, Mississippi, Mr. Brasfield attended Georgia Tech.

specializing in transmission line engineering. His first position was with Alabama Power Company as junior engineer. Shortly afterward he was promoted to office engineer, Distribution Retail Department. In 1932, he became distribution engineer, which position he held until 1935, when he was named service supervisor.

* * *

Herbert Metz, of the Graybar Electric Company, was elected chairman of the Executive Committee of the National Adequate Wiring Bureau at a meeting held in New York on Monday, December 15. Mr. Metz succeeds W. E. Sprackling, vice-president, Anaconda Wire & Cable Company, who has so ably guided the affairs of the Bureau since this all-industry program was launched nearly four years ago.

Mr. Metz has already made an outstanding contribution to the program, having been identified with the operation as chairman of the Plan Committee, since it was initiated. He brings to the chairmanship a wide background of experience in the electrical industry.

After graduation from Penn State with the degree of B.S. in E.E., his first business connection was with the Western Electric Company in Chicago from which, in 1915, he joined the advertising department of the general headquarters of that company in New York. In 1923, when the Western Electric supply and telephone departments were split, he was made advertising manager of the Supply Division.

In 1926, when the Graybar Electric Company was organized, Mr. Metz became advertising manager, and, in 1928, was made sales promotion manager. Since July, 1939, Mr. Metz has held the position of general lamp and lighting sales manager.

* * *

Edmund A. Orrell, recently zone manager for White Motor Truck Co., has been appointed district manager in the Raleigh, N. C., territory for the Airtemp Division of Chrysler Corporation, according to an announcement by **Paul B. Zimmerman,** vice-president and general sales manager.

Orrell brings to Airtemp a long background of sales experience which includes managership of branch offices in this country and abroad, and covers merchandising of such a wide range of products as mechanical leather goods, cosmetics, securities and motor trucks.

In his new connection, Mr. Orrell will be responsible for the development of Airtemp dealers in the Raleigh territory and the servicing of their requirements. Airtemp makes a complete line of heating, air-conditioning and commercial refrigeration equipment.

Have You Investigated the New Method of Conditioning Right-of-Way?

Gone are the days of heavy maintenance costs for right-of-ways. Gone is the necessity for transmission line patrolmen to force their way through wildernesses of brush and small trees to conduct their daily routine inspection of high tension lines. ASPLUNDH right-of-way clearance now makes it possible to grow grass where only dense brush grew before.

The brush is gone because it's out. The machine has conquered the wilderness, and the machine does its work in days what formerly required weeks of hard labor and does it so thoroughly that in a few years further growth is discouraged. Investigate the speed and low cost of this specialized service. Select one of several types of contracts to serve your needs. KEEP YOUR RIGHT-OF-WAYS CLEAR!

WRITE FOR REPRESENTATIVE
TO CALL, OR INQUIRE
AT ANY OF THESE BRANCH OFFICES:

Chicago, Ill.	Baltimore, Md.
Binghampton, N. Y.	Durham, N. C.
Columbus, Ohio	Rutherford, N. J.
Cambridge, Mass.	New Castle, Pa.
Alexandria, Va.	Pittsburgh, Pa.
Washington, D. C.	Omaha, Nebr.
	Tulsa, Okla.

ASPLUNDH TREE EXPERT COMPANY
505 YORK RD. JENKINTOWN, PA.

Since time immemorial, the wedge has been the orthodox method of tightening and permanently joining two bodies together.

"Gorilla Grip" Mechanical Connectors use two types of this wedging principle to insure a mechanically as well as electrically perfect connection.

No special tools are required for any "Gorilla Grip" installation. The Connectors will not loosen after the connection is made and they may always be reclaimed for use again.

There is a "Gorilla Grip" Connector for every connection wherever it taps or terminates. Investigate, write for literature.

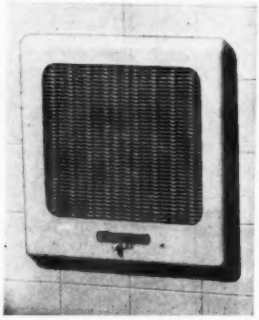
National Electric
PRODUCTS CORPORATION
300 FULTON BUILDING, PITTSBURGH, PA.

NEW EQUIPMENT and MATERIALS

Bilt-in-Wall Electric Heater

The newest addition to the Electromode electric unit heater line, the Bilt-In-Wall Electric Heater, Model WJ 15, has just been announced by the Electric Air Heater Co., Division of American Foundry Equipment Co., Mishawaka, Indiana. This smartly styled, streamlined cabinet contains the exclusive cast-in electric safety element that has revolutionized electric heating. There are no exposed hot wires or glowing elements of any kind.

A flip of the switch starts a flow of cheerful, mellow heat. A quiet motor-driven fan distributes warm air



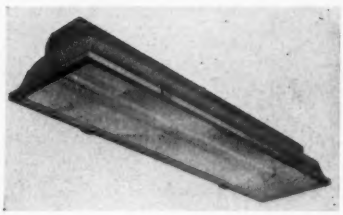
uniformly throughout the room giving heat where it is needed most—in the "living zone." The simple beauty of the modern grille which blends gracefully into any setting combined with a surprisingly low operating cost makes this new Bilt-In-Wall Electromode the answer to the hard-to-heat room problem.

Complete details, specifications and a series of attractive line drawings which illustrate a few of the many possible bilt-in comfort uses of this auxiliary heater are included in Bulletin No. 45.

"High Vision" Luminaire

To speed up production in industrial plants, where extended light lines are desirable, a new 40-watt fluorescent luminaire is announced by the Westinghouse Electric and Manufacturing Company.

Known as type FPS-40, the luminaire uses two or three 40-watt fluorescent lamps per reflector and will provide lighting intensities of from 30 to 100 footcandles with maximum diffusion, minimum glare and uniform distribution at ordinary spacing and mounting heights. It provides adequate visibility for close work such as reading precision micrometers, veniers, and other shop instruments.



Design of luminaire makes it possible to construct any length of strip desired from four simple and compact types. Channels provide a continuous wireway which may be mounted on conduit, messenger cable, twin-rod suspension or directly on the ceiling. All auxiliary equipment is mounted in the channel. The units have twin-ballasts with built-in compensators providing power factor of 90 per cent or over.

Edwards Door Chimes

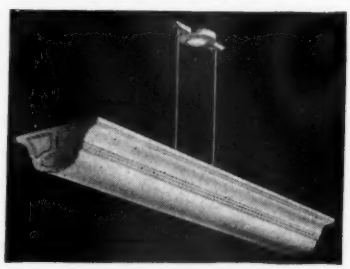
Edwards & Co., Norwalk, Conn., announce the publication of the new 1941 catalogue, completely illustrating and describing their current line of electric door chimes.

An unusual feature of this new 16 page edition is a chart which serves as guide in selecting the proper chime for any type of decorative scheme. Various furniture periods are listed and each is identified by a fascinating little picture of a chair characteristic of its time. The correct Edwards Chimes are indicated for each period.

Guth Indirect Flu-O-Flector

The Guth Indirect Flu-O-Flector is a new luminaire development designed by the Edwin F. Guth Co., St. Louis, to provide the quality and refinement of indirect illumination with efficient economical fluorescent light sources.

Wider light distribution is made possible in this luminaire by the engineered shape of the reflector and the characteristic form of fluorescent lamps. The broad light spread of the



Defense Savings Pay-Roll Allotment Plan

How company heads can help their country, their employees, and themselves

voluntary pay-roll allotment plan | helps workers provide for the future | helps build future buying power | helps defend America today

This is no charity plea. It is a sound business proposition that vitally concerns the present and future welfare of your company, your employees, and yourself.

During the post-war period of readjustment, you may be faced with the unpleasant necessity of turning employees out into a confused and cheerless world. But you, as an employer, can do something *now* to help shape the destinies of your people. Scores of business heads have adopted the Voluntary Pay-roll Allotment Plan as a simple and easy way for every worker in the land to start a *systematic* and *continuous* Defense Bond savings program.

Many benefits . . . present and future. It is more than a sensible step toward reducing the ranks of the post-war needy. It will help spread financial participation in National Defense among all of America's wage earners.

The widespread use of this plan will materially retard inflation. It will "store" part of our pyramiding national income that would otherwise be spent as fast as it's earned, increasing the demand for our diminishing supply of consumer goods.

And don't overlook the immediate benefit . . . money for defense materials, quickly, continuously, *willingly*.

Let's do it the American way! America's talent for working out emergency problems, democratically, is being tested today. As always, we will work it out, without pressure or coercion . . . in that old American way; each businessman strengthening his *own* house; not waiting for his neighbor to do it. That custom has, throughout history, enabled America to get things done *of its own free will*.

In emergencies, America doesn't do things "hit-or-miss." We would get there *eventually* if we just left it to everybody's whim to buy Defense Bonds when they thought of it. But we're a nation of businessmen who understand that the way to get a thing done is to *systematize* the operation. That is why so many employers are getting back of this Voluntary Savings Plan.

Like most efficient systems, it is amazingly simple. All you have to do is offer your employees the convenience of having a fixed sum allotted, from each pay envelope, to the purchase of Defense Bonds. The employer holds these funds in a separate bank account, and delivers a Bond to the employee each time his allotments accumulate to a sufficient amount.

Each employee who chooses to start this savings plan decides for himself the denomination of the Bonds to be purchased and the amount to be allotted from his wages each pay day.

How big does a company have to be? From three employees on up. Size has nothing to do with it. It works equally well in stores, schools, publishing houses, factories, or banks. This whole idea of pay-roll allotment has been evolved by businessmen in cooperation with the Treasury Department. Each organization adopts its own simple, efficient application of the idea in accordance with the needs of its own set-up

No chore at all. The system is so simple that A. T. & T. uses exactly the same easy card system that is being used by hundreds of companies having fewer than 25 employees! It is simple enough to be handled by a check-mark on a card each pay day.

Plenty of help available. Although this is *your* plan when you put it into effect, the Treasury Department is ready and willing to give you all kinds of help. Local civilian committees in 48 States are set up to have experienced men work with you just as much as you want them to, and no more.

Truly, about all *you* have to do is to indicate your willingness to get your organization started. We will supply most of the necessary material, and no end of help.

The first step is to take a closer look. Sending in the coupon in no way obligates you to install the Plan. It will simply give you a chance to scrutinize the available material and see what other companies are already doing. It will bring you samples of literature explaining the benefits to employees and describing the various denominations of Defense Savings Bonds that can be purchased through the Plan.

Sending the coupon does nothing more than signify that you are anxious to do *something* to help keep your people off relief when defense production sloughs off; *something* to enable *all* wage earners to participate in financing Defense; *something* to provide tomorrow's buying power for your products; *something* to get money *right now* for guns and tanks and planes and ships.

France left it to "hit-or-miss" . . . and *missed*. *Now* is the time for *you* to act! Mail the coupon or write Treasury Department, Section A, 709 Twelfth St. NW., Washington, D. C.

FREE - NO OBLIGATION

Treasury Department, Section A,
709 Twelfth St. NW., Washington, D. C.

Please send me the free kit of material being used by companies that have installed the Voluntary Defense Savings Pay-Roll Allotment Plan.

Name _____

Position _____

Company _____

Address _____

GPO 428408

Indirect Flu-O-Flector eliminates the "hot-spot" of light usually concentrated directly above indirect luminaires. The efficient light distribution of the unit also permits wider spacings and makes the fixture ideally suited for low ceiling installation even when only a small drop can be used.

The Indirect Flu-O-Flector has a durable "300° White" inner reflector that affords higher lighting efficiency. The ornamental stamped steel ends of the fixture are welded to the upper half of the luminaire and the lower bottom of the fixture basin is easily removed for convenient installation or servicing. Joined to the underside of the reflector are the accessories for the 2-40, 65 or 100 watt lamps which various sizes of the Indirect Flu-O-Flector accommodate. The Guth Indirect Fluorescent Luminaire is available with single or double stem hangers and can be mounted individually or in continuous rows without use of extra parts.

New "Fluorescent Tester"

One of the problems in connection with fluorescent lighting has been solved with the introduction of a new Mitchell "Fluorescent Tester." With this device, fixtures, bulbs, starters and ballasts may be accurately tested to determine cause of failure and to enable units to operate efficiently. The tester is simple to operate and tells immediately which of several component parts needs replacement. It is not necessary to remove fixtures from the ceiling to find out what is wrong, nor to ship unit back to the factory. All size lamps may be tested from 15 to 100 watts, as well as starters and ballasts for the different wattage lamps. The tester is lightweight and compact enough to fit into the palm of your hand. Weighs only a pound. Every contractor, electrician or maintenance man can find many uses for this tester, which sells for $7.50 net. Can be obtained from leading wholesale supply distributors.

New Fluorescent Starter

A new fluorescent starter, to be known as the Protector-Starter, is under development by the accessory equipment section of the General Electric appliance and merchandise department, Bridgeport, Conn. The Protector-Starter is designed to eliminate blinking fluorescent lamps by automatically cutting them out of the circuit. This action prevents the starter from destroying itself in trying to start a defective or worn-out lamp. It also may save ballast equipment by eliminating the possibility of a closed circuit condition creating excessive temperature rise.

The conventional fluorescent starter is developed for many hours of normal lamp starting, G-E engineers point out. As is generally known, however, when a worn-out lamp is flickering constantly, yet cannot be replaced for some time due to inability to get at the fixture, the starter can wear itself out within a relatively few hours. The new Protector-Starter is designed to cut out the lamp and prevent this from happening. When a new lamp is installed, the Protector-Starter is again ready to function.

Plastic Tenite Appliance

The tenite-covered floor outlet at the left is a modernized, redesigned version of the older brass fitting at the right. The new outlet, which

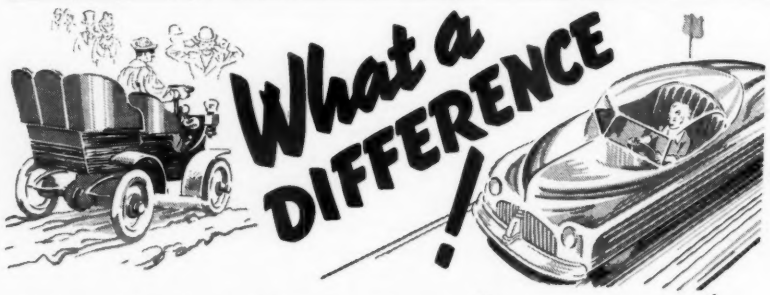
is replacing the metal appliance, is made of three zinc parts coated with plastic. It requires no machining or polishing for finishing as does the one made of brass, which is assembled from four castings. The new plastic outlet is molded by the American Insulator Corporation, New Freedom, Pa., for the Fibre Conduit Company, New York City. Tenite is manufactured by the Tennessee Eastman Corporation, Kingsport, Tenn.

G-E Deltabeston Wire Catalog

A new catalog on Deltabeston asbestos-insulated and glass-insulated wires and cables has been published by the Deltabeston sales section of the General Electric appliance and merchandise department, Bridgeport, Conn. This catalog illustrates and describes the whole Deltabeston line, including power cables, switchboard wires, appliance wires, fixture wires and cords, locomotive cords, magnet wires, etc.

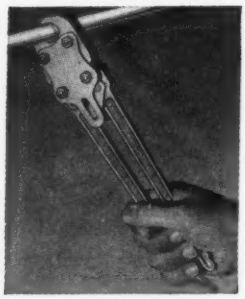
Much technical data is given in the catalog on materials used in the manufacture of Deltabeston wires and cables and on the construction of wire. Tests made are described.

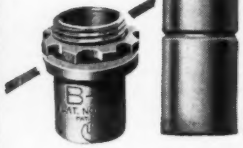
Yellow tabs separate the sections of the catalog making it easy to use. Each section is devoted to a different type of wire. Two indexes are also provided—one a subject index, the other a table number or numerical index.



And there's just as much difference between the *streamlined* BRIEGEL METHOD of making connections and former old-fashioned methods.

The BRIEGEL METHOD saves you up to 50% on time and a substantial saving on materials allowing you a larger margin of profit on each job. Make quick, easy, strong and neat connections this MODERN way.





No extra turns or twists, no nuts to tighten when you use B-M connectors and couplings. Just TWO SQUEEZES with the patented B-M indenter (which costs you only $1.25) and you have a smooth efficient job. Approved by Underwriters Laboratories.

DISTRIBUTED BY

The M. B. Austin Co.
Chicago, Ill.
Clayton Mark & Co.
Evanston, Ill.
Clifton Conduit Co.
Jersey City, N. J.
General Electric Co.
Bridgeport, Conn.
The Steelduct Co.
Youngstown, Ohio
Enameled Metals
Pittsburgh, Pa.
National Enameling & Mfg. Co.
Pittsburgh, Pa.
Triangle Conduit & Cable Co.
Elmhurst, N. Y. C.

BRIEGEL METHOD TOOL CO., Galva, Ill.

Magnetic Starters

A complete new line of Magnetic Solenoid Starters and Contactors, Sizes "0" and "1" has been announced by The Arrow-Hart & Hegeman Electric Co., Hartford. Conn.

Separate Bakelite units for each pole confine the arc and exclude dust. All connections are made from the front, and coils with clearly visible ratings are easily changed. Separate electrical interlock switch, enclosed in Bakelite, is supplied normally open or closed.

Reset button is independent of the cover. Positive quick make and break switching mechanism in overload relay is insulated from the bimetal and heater. Overload relays are regularly supplied for manual reset, but can be changed for automatic reset if desired. Standard A-H&H heaters are used.

For control of motors up to 7½ H.P. Single or Polyphase 110-550 V. A.C. Described on Catalog Inserts 37-A, 38-A, 52-A, and Heater Table 74.

Adjustable Bar Hanger

The new Appleton S-29 Adjustable Bar Hanger illustrated below replaces the regular straight, shallow, and deep offset Bar Hangers. Made in two parts and held together by means of a special type set-screw stud. Note the four prongs, two in each end, so that the bar hanger can be securely fastened to the joist by means of an ordinary hammer; no nails are required.

The use of this bar hanger eliminates the possibility of any bulge ap-

pearing on the surface and is regularly used in connection with various surfacing materials such as plaster board, sheetrock, wall board, pressed wood, beaver board, nu-wood, metal lath, lath and plaster, etc.

Manufactured by Appleton Electric Company, Chicago, Illinois, makers of the well-known line of Unilets and other Appleton Fittings.

New Wiremold Catalog

Recently issued by The Wiremold Company, Hartford, Connecticut, new Fluorescent Lighting Catalog Section FL-4 and accompanying Catalog and Price Sheet FL-5A, list and describe the new Wiremold DeLuxe Glass-Enclosed Fluorescent Lighting Units and Line-O-Lamps, and in addition give preliminary price and specification data on the latest Wiremold development of a 4-lamp V-type lighting unit for use with or without ornamental end fittings. Copies of these two catalog sections will be sent on request.

A new series of Wiremold V-Type Two-Lamp Industrial Units with porcelain enamel reflectors, using the basic Wiremold No. 3000 Channel and fittings and providing utmost flexibility in installation either as single or multiple two-lamp units making continuous runs of double Line-O-Lamps comprising any desired number of lamps. Available for 20W or 40W fluorescent lamps.

Hipersil Transformers

Distribution transformers up to 500 kva made of Hipersil, the newly developed silicon steel, are described in a 22-page bulletin announced by Westinghouse Electric and Manufacturing Company.

Use of Hipersil to give better regulation, increased flux, and reduced size and weight is discussed in detail. A description of magnetostriction tests shows why Hipersil increases the flux without raising the sound level.

A copy of bulletin B-2287 may be secured from department 7-N-20, Westinghouse Electric and Manufacturing Company, East Pittsburgh Pennsylvania.

G-E Varnished Tubing

A cardboard folder containing six actual samples of G-E varnished tubings, and full information about them, has been published by the insulating materials section of the General Electric appliance and merchandise department, Bridgeport, Conn.

When opened, the folder becomes a reference card which may be fastened to the wall. The different colored tubing samples can be removed for inspection and replaced easily.

Rewinding Series Motor Armatures

(Continued from page 44)

Therefore, careful field coil and re-fielding maintenance can be made to pay good dividends. In fact, one user of such motors reduced their armature re-winds from 207 to 94 per year, by using new fields in a frame with a rewound armature; this reduction in total number of armatures rewound was accomplished in spite of the fact that production had been almost doubled.

Operating Practice

Another large operating company in the East has established the policy of removing all field coils, main and commutating when a motor is shopped for field trouble or armature burn outs. The field coils are then carefully checked and tested between turns and layers with a high voltage of high frequency (minimum of 1,500 volts per coil). Good coils are reinsulated and marked as rebuilt coils, as this concern has adopted the plan of installing either all new coils or all rebuilt coils in

COMPLETE WITH DE LUXE ACCESSORIES

FUNNEL HOLDER COFFEE MEASURE HINGED DECANTER COVER CORY GLASS ROD

THE CORY COFFEE BREWER

REG. U.S. PAT. OFF.

- CORY-brewed Coffee and Tea are flavor-protected—untouched by metal.
- CORY Brewers are outstanding for beauty of design and value. Three sizes fill all needs — trimmed in black, walnut-tone and ivory-tone. Price range $2.95 to $5.25.
- CORY Glass Filter Rod fits other makes — a *sensational seller* at *50 cents.*

WRITE for the complete CORY catalog.

CORY 2-HEAT ELECTRIC STOVE

High heat for brewing—low for keeping coffee hot. Use with glass coffee makers of any size, any make

$3.95

CORY GLASS COFFEE BREWER CO. (NOT INC.)

325 North Wells Street Chicago, Illinois

any one such series motor frame.

When re-fielding any series motor with either new or re-built field coils the pole seat on the frame, and on the pole piece, should both be cleaned with a wire brush, etc., to insure good contact over the full area of the pole seats.

From the foregoing, it is obvious that it is quite possible to put a new field coil in with coils weakened by previous overloads, or the shorted coil or coils, may still be in the circuit. In other words it is poor policy to mix field coils of unknown condition with rewound armatures.

Showmanship in Your Sales Promotions

(*Continued from page 29*)

is held twice weekly in the appliance department's own electric kitchen, one being for white and one for colored women. Small groups of eight to twelve persons are favored for these meetings which are slanted more toward actual selling than prospect obtaining as was the old type cooking school, usually held in a large auditorium. Home economists for the Birmingham Electric Company help to conduct these cooking schools at which actual meals are prepared and then served to the small group of visitors.

The remodeled appliance department besides boasting of an electric kitchen is fluorescent lighted and air conditioned. There is plenty of wall space for the display of appliances, also several booths where radios may be demonstrated without noise elsewhere in the department. The phonograph record department was greatly expanded and also has booths where records may be played. Floors throughout the department are of two-tone linoleum. The walls are papered.

The department normally buys five or six carloads of merchandise per month and in recent months has gone into the market and purchased used appliances on the same basis in order to meet the demand. Used refrigerators and radios are kept displayed in the department as well as new models.

Mr. Allen said his salesmen were trained to sell the complete line rather than concentrate on any one appliance to the exclusion of the others. He feels certain that this is the best plan just as the football coach tries to build a well-rounded eleven rather than depend on the exploits of one or two star players.

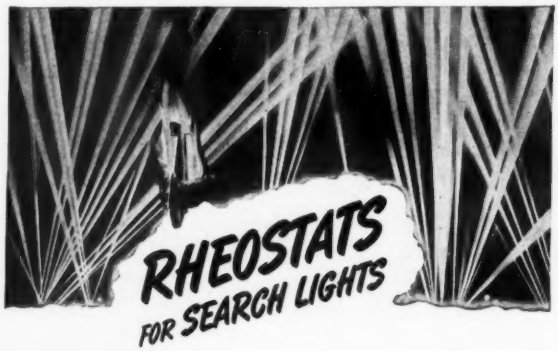
Oklahomans Visit "Reddy Kilowatt"

(*Continued from page 27*)

of electrical service—cost of lighting, both incandescent and fluorescent, cost of operating a refrigerator in Oklahoma, as compared with the United States national average, etc.

One booth was devoted entirely to meters, showing different types, domestic and commercial, some in operation.

There was a "safety" booth, showing the gadgets the linemen use in handling hot wires and containing other safety equipment. Another one showed different types of lamp bulbs, varying from one burning but six hours to another of 3,000-hour capacity. In this booth was a replica of the



The search-lights of tonight that can locate flying death in the heavens are far different equipment from the much publicized lights that guided gun fire on Admiral Dewey's ships. Improvements in search-lights during the past fifty years have been comparable with improvements in all electrical equipment. It has been the privilege of the Ward Leonard organization to design and build most of the controls for search-lights through the entire development period. It is not surprising, therefore, that this invaluable experience should be enlisted by our government.

WARD LEONARD

RELAYS • RESISTORS • RHEOSTATS

Electric control (WL) *devices since 1892.*

WARD LEONARD ELECTRIC COMPANY, 37 SOUTH ST., MT. VERNON, N. Y.

STREAMLINE DESIGN.
TOTALLY ENCLOSED MOTOR.
SELF-LUBRICATING BEARINGS, WITH WOOL PACKED OIL RESERVOIR.
CHROME PLATED FAN BLADES.
QUIET OPERATION.
EASY-TO-MOUNT FRAME.

SIGNAL *Challenger* VENT FANS

Here is the biggest Vent Fan value today. Nothing approaches it in quality, performance, and price. Features like these are unusual in a Vent Fan of the same price range — enclosed motor with large oil reservoirs, chrome plated fan blades, streamline design, square panel for easy mounting, adjustable conduit box, horizontal or vertical operation.

Write for complete information now.

SIGNAL ELECTRIC MFG. CO.
Menominee, Michigan

Branch Offices:
W. E. Hopper
357-59 Marietta St., Atlanta, Ga.
Geo. E. Anderson
Santa Fe Bldg., Dallas, Texas

SIGNAL

"Automatic"
TIME
CONTROL DEVICES

Models for

Any desired time cycle
Any function specified
Any performance wanted

PROCESS TIMERS

INTERVAL TIMERS, or PROCESS TIMERS, are furnished in two types. One is reset by hand (manually); other resets itself automatically. Both types can be provided for practically any cycle of time, fully adjustable from zero to maximum period. SYNCHRONOUS, SELF-STARTING MOTORS.

SIGNAL TIMERS

Used extensively for starting and stopping industrial work; school class periods; for municipal time signals, etc. Up to six signal periods, permanently set at factory with Sunday & Holiday Cutout and Manual Control, at a price of only $35.

TIME SWITCHES

Triple Pole • Double Pole • Single Pole

All three types can be furnished with capacities ranging from 20 TO 200 AMPERES PER POLE, from $12.00 up. Ten ampere Time Switches from $3.95 up.

Write for Information

AUTOMATIC ELECTRIC MFG. CO.
MANKATO, MINNESOTA

Here's The Varnish
For High Speed Armatures!

If the insulating varnish used on high speed armatures does not cure to a solid mass, there is always the possibility of coil movement occurring inside the slots. This condition often leads to internal short circuiting of the windings.

DOLPH'S SYNTHITE No. 153-Y Clear Baking Varnish, when baked properly, holds the motor windings compactly preventing coil movement or throw-out resulting from centrifugal force developed in high speed armatures. This varnish has the excellent binding properties so necessary when extreme rigidity is required.

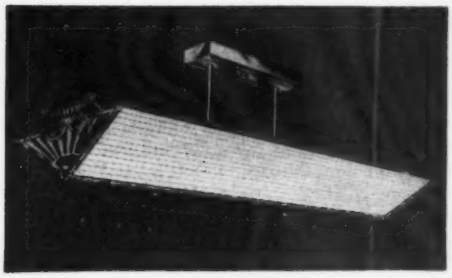
SYNTHITE No. 153-Y Clear Baking Varnish is a synthetic resin type of varnish, benzine thinned, and provides the additional economy of a faster baking schedule, utilizing temperatures of from 240°F. to 300°F. SYNTHITE No. 153-Y Clear Baking Varnish is also available in a cherry red or pale water white color, another feature which will contribute greatly to the eye appeal of your finished job.

A free working sample of this remarkable varnish will be furnished motor repair shops or industrial maintenance departments upon request.

Dolph's
JOHN C. DOLPH COMPANY
Insulating Varnish Specialists
166 EMMETT ST. NEWARK N. J.

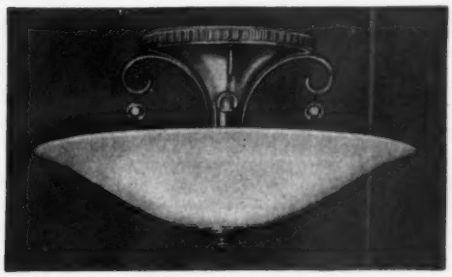
For Smart Fixtures that are the Ultimate in Efficiency See the latest
GLOBE *Liners*

**For Commercial and Industrial Use . . .*



NEW GLOBE FLUROLUME models . . . High in Quality and Efficiency . . . Moderate in Price.

**New TEE Line Models for Residential Use . . .*



These new fixtures represent the last word in incandescent lighting for the home.

Send for these three New Catalogs:

1. Residential Fluorescent. 2. Residential Incandescent 3. Commercial Fluorescent . . . No Obligation

Representatives for GLOBE in the South:
Mr. Henri Duizend, 2811 Dublin, New Orleans, La.
Anderson-Shattuck, 3117 University Blvd., Dallas, Tex.
Mr. S. M. Wittenberg, 531 Santee Ave., Columbia, S. C.

When in New York - Visit the New Globe Showrooms*

* WHOLESALE ONLY

At 16 East 40th Street,
(Just East of Fifth Avenue)

GLOBE
LIGHTING FIXTURE MFG. CO
Factory Brooklyn N. Y.

first Edison electric lamp.

The story of adequate wiring was admirably told in another booth. There was also a booth on customers' service, showing the extra service one gets through the use of electricity.

One very interesting feature of the show was the pole assembly. It was regulation in every respect except in height, being six or eight feet high or taller, according to space in the room. On it were cross arms, different types and sizes of wires and every item that goes on a pole, with everything labelled, and a general card stating that on every pole where there is a transformer there are some 131 different items.

Local linemen were on hand to show the equipment. This exhibit gave many people the opportunity of seeing the top of a pole for the first time and having it explained to them. Below or next to the pole were two transformers, one cut away to show its construction and the other filled with oil and lighted to show the inside.

There were enlarged photographs of plants, transmission lines, trucks, etc., placed on easels or in show windows. Also, there was an "animated" history of the company on large pages folding over so visitors could read them handily. There were pictures of plants, of employees, etc., and figures on taxation and the purchase of materials. Each show was localized to a certain extent, showing what the company pays in that county for school taxes, etc.

"What's Watt," a talking picture of some twenty minutes duration, was shown, usually in the back part of the room.

Local people were in charge of the booths as much as possible; and the local merchants were invited to show their appliances. The mayor was on hand at the opening of each show. The local home demonstration girl was there to show the latest developments in electric cookery. School classes, women's clubs and other organizations were invited to attend in a body.

All visitors were asked to register when they came in. Women were given a "Reddy Kilowatt" hot plate pad. After visitors registered, greeters were on hand to provide them a "personally conducted" tour of the show, if desired, or they could wander around at will. Refreshments were served—cookies and coffee or punch, served by the wives of employees.

Better Management For Your Business

(*Continued from page 21*)

his books as guides and advisors to future operation but they cannot supply this service unless all expenses are pro-rated properly so that true departmental profits are shown. The departmental recording of sales, cost of sales, and direct expense is not enough to determine departmental efficiency because indirect expenses are not allocated and you are never sure of departmental profits until the last expense dollar is properly pro-rated.

Pro-rating the overhead does not involve the bookkeeping procedure unduly. Those who departmentize their direct expenses have only to make a journal entry transferring the total of indirect expenses to the various departments on a percentage basis as shown here. Those who do not departmentize need only add departmental columns in the journals and departmental pages in the ledger. Little additional book work is involved for the many advantages of departmentization and complete allocation of overhead expense.

It won't be hard to sell electrical installations during the next few years but it will be hard to make a profit on sales unless the contractor is tops in managerial efficiency. And you can't be tops in managerial efficiency unless you keep records that are tops in comprehensibility. You must know exactly where you stand in each department so that you can take intelligent action for betterment and forge ahead in the clear.

Many electrical contractors are weak on costing, and today it is more important than ever before that they know what it costs them to run every department of the business. To this end, the accurate and complete proration of overhead expense is of prime importance. Our experience indicates that direct departmental costing, the computation of wages and materials used on jobs, is done more accurately because it is a

Better Lower Cost **WIRING**

IDEAL Wire-Nuts

SOLDERLESS, TAPELESS, WIRE CONNECTORS
STRIP WIRES, SCREW ON, THAT'S ALL!

Cut Costs, Do Better, Safer Work—beat contract dates—on Fluorescents and all other electrical wiring, with IDEAL "Wire-Nuts." No solder, no tape, no open-flame torch. Millions in use. Fully approved; Listed by Underwriters' Laboratories, Inc.

Free Samples On Request

IDEAL

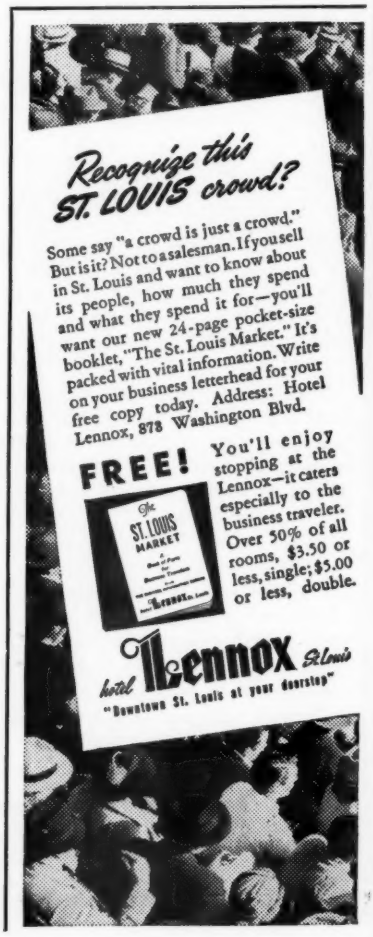
FISH TAPE, REEL and PULLER

Saves expensive tape breakage. Keeps Fish Tape under control at all times. Many sizes available. No. 00 size with 50 Ft.—⅛"x.045" tape only $1.50.

Other Handy IDEAL Tools

IDEAL SOLD THROUGH JOBBERS

IDEAL COMMUTATOR DRESSER COMPANY
1017 Park Avenue Sycamore, Illinois
"SALES OFFICES IN ALL PRINCIPAL CITIES"


Recognize this ST. LOUIS crowd?
Some say "a crowd is just a crowd." But is it? Not to a salesman. If you sell in St. Louis and want to know about its people, how much they spend and what they spend it for—you'll want our new 24-page pocket-size booklet, "The St. Louis Market." It's packed with vital information. Write on your business letterhead for your free copy today. Address: Hotel Lennox, 878 Washington Blvd.
FREE!
The ST. LOUIS MARKET
You'll enjoy stopping at the Lennox—it caters especially to the business traveler. Over 50% of all rooms, $3.50 or less, single; $5.00 or less, double.
hotel Lennox St. Louis
"Downtown St. Louis at your doorstep"

INSTANTANEOUS

Electric HEATERS

HOT or COLD WATER from the SAME FAUCET—when you want it.

• • • The Instantaneous Electric Water Heater is not a portable lamp socket device, but—as shown—is a compact, self-contained apparatus (10½x4¼ inches). Quickly and inexpensively installed. Operates on AC.

Approved by Underwriters Laboratories, Inc.

DISTRIBUTORS WANTED

Mfg. By THE ELECTRIC HEATER COMPANY
BRIDGEPORT, CONNECTICUT, U. S. A.

IT'S TIME TO SWITCH TO

Paragon

. . . especially to **PARAGON 300 SERIES TIME SWITCHES** — leaders in a group of precision built time switches, resulting from 36 years of research and progressive manufacturing.

SERIES 300 is ideal for signs and general time switch applications, for day-night control of stokers, oil burners, gas burners, signs, commercial lights, attic fans, blowers, pumps, valves, motors, etc.

Just 2 exposed gears; all other gears operate in an oil filled chamber; absolutely dust-proof. 2000% extra dial power. 18 gauge steel case.

300 SERIES

Many other types available. Send for a complete catalogue. . . .

PARAGON ELECTRIC CO., 409 So. Dearborn Street, Chicago, Ill.

Southern Representatives

William E. Hopper
357 Marietta Street, N. W.
Atlanta, Georgia

George E. Anderson Co.
Santa Fe Building
Dallas, Texas

Large Stocks for Immediate Shipment in Atlanta and Dallas

Paragon Chicago

BUILDERS OF CONTROL INSTRUMENTS SINCE 1905

VARSLOT INSULATION

REDUCES BREAKDOWNS DUE TO GROUNDS

★ ★ ★ ★ ★

★ Varslot Slot Insulation is a combination of 100% rag paper and black varnished cambric, cemented together. Varslot provides great mechanical strength as well as high dielectric strength. Varslot protects motors against breakdowns due to grounds, and is your customer's DEFENSE against machinery breakdown.

VARTEX VARNISHED CAMBRIC INSULATION provides unexcelled electrical protection against oils, moisture, acids, and alkalies. Multiple coats of insulating varnish baked on superior grades of fabrics produce high dielectric strength. Vartex Cambric Insulation also provides defense against motor breakdowns.

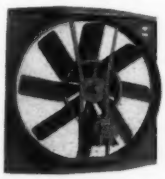
Write for the BLUE CATALOG!

Distributed by:

INSULATION and WIRES, Incorporated
2127 Pine Street, St. Louis, Missouri
289 Simpson Street, N. W., Atlanta, Georgia

Serve

Your Nation's War Industries through COOLAIR



Coolair's Scientific Breeze-conditioning means greater employee efficiency — *faster production* in America's vital industries. Proper ventilation is undoubtedly needed in factories near you—not only in plants producing war materials but also in allied units such as laundries, bakeries, canneries and garment factories. You can benefit your nation and yourself by introducing Coolair's Industrial Exhaust Fans to every plant manager in your section. Write for free catalogues today!

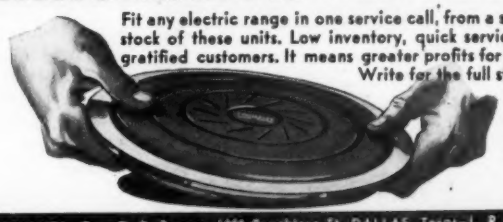
Coolair Ventilating and Cooling Systems

AMERICAN COOLAIR CORPORATION
Manufacturers . . . . JACKSONVILLE, FLORIDA

There's profit in replacements with

CHROMALOX RANGE UNITS

Fit any electric range in one service call, from a small stock of these units. Low inventory, quick servicing, gratified customers. It means greater profits for you. Write for the full story.



ATLANTA, Ga.-C. B. Rogers, 1000 Peachtree St. DALLAS, Texas-L. R. Ward, 403 Southland Bldg. Annex. RALEIGH, N. C.-W. R. Phillips.

EDWIN L. WIEGAND CO., 7600 Thomas Blvd., Pittsburgh, Pa.

matter of merely figuring quantities and labor hours. The big errors creep in when the contractor starts computing overhead expense.

Many assume that pro-rating is a complex operation but, as this article indicates, it is easy to handle. We commend the pro-rating of overhead expense as outlined here to every electrical contractor. Such action is in keeping with modern demands for greater efficiency in business and will pave the way to bigger sales and profits.

Testing Routine for Industrial Motors

(*Continued from page 17*)

checked. Locked rotor currents are generally used when there has been a change in design or where there is some doubt as to the correctness of the winding as compared with standards on file.

It has been my experience that a load test will locate trouble which might not show up in any other way and is well worth while. Small dynamometers are not hard to make and will show about everything you need to know on load testing up to 3 hp by using a pull on and ordinary spring scale with a dial properly calculated so as to show pounds of pull or horsepower, an ammeter to show load, as well as a voltmeter to show pressure. Such an outfit can be built for amounts varying from $75 to $300 and are worth every cent they cost.

For larger tests a load bank can be built from old grids and a generator used to load up a motor by means of belting, proper allowances being made, of course, for belt losses.

Direct Current Machines

On direct current machines, the standard tests used by most every armature winder are recommended: namely, shorts, grounds and opens. When the complete machine is available make a no-load running test and check speed, no-load amperes, and field amperes.

For interpole machines, check for proper interpole connections and correct brush position. A simple combination test for this is to send current through armature and interpole only with series and shunt fields disconnected. A suitable line rheostat should be provided to keep current within full load limits. When the brushes are in the correct neutral position, the armature will not rotate. If the brushes are shifted in either direction from neutral, the armature will rotate in the direction of shift from neutral with correct connections. When the non-rotating neutral band is broad, a shift in both directions will usually define the correct mid point neutral accurately.

Capitalize Your Past Experience

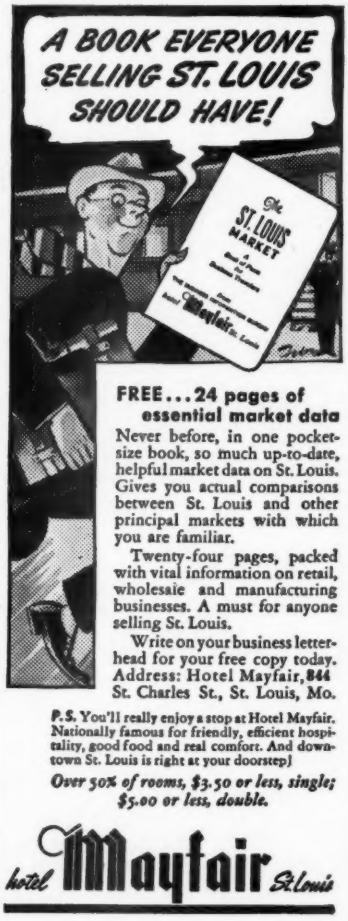
(*Continued from page 19*)

across the top and the work completed. Because it was portable, it was easily moved from one location to another.

"Labor is the most important figure in any cost estimate and, consequently, must be most closely guarded. What is meant is that if we overlook something in making an estimate so that our bid will be lower than it should, our loss will be greater because we will not only lose the cost of the materials, but the labor required for their installation as well.

"Many contractors are often puzzled because a job on which a profit had been figured fails to deliver that profit. This may be due to carelessness in looking after materials, loss of tools, loss of equipment, and similar shortages. The loss of a little wire, a plug or part of a bar of solder may not seem much, but if this practice becomes established, many dollars may become involved.

"We are now working on a job for a local bank which is a bit unusual because it is the first of its kind in this section. The ceiling is made up of a series of coffers, each approximately nine feet square. The lighting is indirect, the fixtures being suspended from the center of the coffers, throwing their light against the ceiling which in turn reflects it back. Plans for this lighting were worked out by the San Antonio Public Service Company, working with the architect, Mr. Harvey P. Smith. It is another experience that will go with its predecessors for possible future use."


A BOOK EVERYONE SELLING ST. LOUIS SHOULD HAVE!
The ST. LOUIS MARKET
Mayfair
FREE...24 pages of essential market data
Never before, in one pocket-size book, so much up-to-date, helpful market data on St. Louis. Gives you actual comparisons between St. Louis and other principal markets with which you are familiar.
Twenty-four pages, packed with vital information on retail, wholesale and manufacturing businesses. A must for anyone selling St. Louis.
Write on your business letterhead for your free copy today. Address: Hotel Mayfair, 844 St. Charles St., St. Louis, Mo.
P.S. You'll really enjoy a stop at Hotel Mayfair. Nationally famous for friendly, efficient hospitality, good food and real comfort. And downtown St. Louis is right at your doorstep!
Over 50% of rooms, $3.50 or less, single; $5.00 or less, double.
hotel Mayfair St. Louis

FREE

BULLETINS AND BOOKLETS ON SALES AND SERVICE

Through cooperation with leading manufacturers, E. S. makes it possible for you to secure the following Helpful Booklets, Reference Bulletins, Handbooks and Catalogs, without cost or obligation. Check the list, fill in the coupon and mail to ELECTRICAL SOUTH, *Grant Bldg., Atlanta, Ga.*

101. SERVICE EQUIPMENT AND LOAD CENTERS—Service Equipment, Load Centers and Panelboards assembled with Type AC circuit breakers are listed in this new publication. In addition to considerable general information, it includes specifications and price data. Frank Adam Electric Company, St. Louis, Mo.

105. COOLAIR HOME-COOLING FANS—FORM 141—Complete descriptions of 1941 Coolair single and twin attic fans, window fan and new automatic ceiling shutter. Also contains valuable installation suggestions. Designated as Form 141. American Coolair Corp., Jacksonville, Fla.

108. AMARINE NON-LEADED SUBMARINE CABLES—FORM 6118—An attractive, 16-page booklet on Submarine Cables, with illustrations of various applications and descriptions of typical installations. Copies may be obtained by writing the American Steel & Wire Co., Rockefeller Bldg., Cleveland, Ohio.

111. NEW CORY CATALOG—The new merchandising features presented in this new catalog are free spare glass with famous CORY Assortments—also the new CORY Glass Filter Rod-Funnel Holder Dollar Combination which makes these needful accessories available to all users of Glass Coffee Makers. Glass Coffee Brewer Corp., 325 No. Wells St., Chicago, Ill.

112. TELEPHONE & CODE CALL EQUIPMENT—A new Bulletin No. 108 is available describing the new Couch "Autophone" System of automatic telephones which incorporates valuable features among which is a Code Call circuit which may be used in conjunction with the telephone system. This system is designed for industrial, commercial and institutional buildings. S. H. Couch Company, Inc., North Quincy, Mass.

113. INTERPRETING THE NEW CODE IN TERMS OF NEW BUILDING WIRES—A new booklet describing the rulings on thin, heat-resisting and synthetic insulations are carefully simplified. The ratings of the newly recognized types of wires and the new ratings for Type R are graphically shown in tables for both the new and rewiring classes of work. General Cable Corporation, 420 Lexington Avenue, New York, N. Y.

114. IDEAL PRODUCTS CATALOG — A special 25th anniversary catalog has just been issued describing the complete line of Ideal Products. Electrical Contractors, Motor Rewinders, and Industrial Maintenance Electricians will be particularly interested in this comprehensive publication. Ideal Commutator Dresser Co., 1270 Park Avenue, Sycamore, Ill.

115. FLUORESCENT LIGHTING ACCESSORIES—Fall Bulletin No. 3, describing and illustrating complete Lloyd line of Fluorescent Lamp Holders, Starters, Starter Sockets and Holder and Socket combinations. Lloyd Products Company, Providence, R. I.

117. MECHANICAL CONNECTORS—First Aid for electrical systems through the use of mechanical connectors is the subject of an interesting twenty-page booklet now available. In addition to specific construction and sales of the new "Gorilla Grip," this booklet describes a wide range of mechanical connectors for every size and purpose. National Electric Products Corp., Pittsburgh, Pa.

120. SQUARE D COMPANY announces the Spring issue of the Square D Digest, dated April, 1941. This condensed catalog contains listings and the latest prices of many Square D products, including Safety Switches, Service Equipment, Multi-breakers and other Circuit Breakers, Panelboards, Motor Control and Pressure Switches. Square D Co., Detroit, Michigan.

129. BULLETIN 403 on BullDog enclosed bus bar system of electrical distribution for commercial and industrial use. Forty-four pages of construction details, applications, dimensional data and technical charts. BullDog Electric Products Co., 7610 Jos. Campau, Ave., Detroit, Mich.

132. INDUSTRIAL WIRING HANDBOOK: This 48-page handbook, called "Adequate Wiring for Industry," describes modern factory wiring methods and materials. Wiring practices adaptable to all factories are outlined. Publ. No. 51-4011. General Electric Co., Appliance and Merchandise Dept., Bridgeport, Conn.

142. ELECTRICAL CONDUIT: Complete technical information on corrosion-resisting asbestos-cement ducts for underground and overhead service, with and without concrete envelop, is included in "Transite Conduit and Korduct for the Electrical Industry," DS Series 410. Johns-Manville, 22 East 40th Street, New York, N. Y.

144. UNIVERSAL ELECTRIC RANGES—Complete line folder giving features of models in Universal 1941 line of electric ranges and telling "Precision Cooking" story. Folder No. 6420. Landers, Frary & Clark, New Britain, Conn.

148. LITTLE GIANT RELAY—A new small Relay for use on A. C. or D. C. is described in a Ward Leonard Bulletin No. 105. The Relay is available in single pole, single or double throw contacts. On standard frequencies, coils can be obtained for 6 to 230 volts. Complete information on contact rating is given in the bulletin. Ward Leonard Electric Co., Mount Vernon, N. Y.

149. ELECTRIC RANGE UNITS: Chromalox Bulletin CF-107 lists proper assembly and adaptor ring to fit any range, regardless of age or make. Inventory investment and servicing reduced to minimum. Units same as used on many makes of new ranges. Edwin L. Wiegand Company, 7600 Thomas Boulevard, Pittsburgh, Pa.

155. ELECTRICAL CONNECTORS — 325 page catalog describing and illustrating Burndy clamp connectors for overhead distribution and transmission, substations, grounding, underground distribution and industrial wiring. Contains 84 pages of useful technical information. Company asks that requests for the catalog, Catalog No. 40, be written on company letterhead. Burndy Engineering Co., Inc., 107 Eastern Blvd., New York City.

156. INTERVAL AND PROCESS TIMERS—Furnished for any cycle of time, fully adjustable, for any purpose, any requirement, or any specified action. Each one built to meet individual specifications. Give information regarding what unit is to be used on, what it is to be used for, and what it is expected to do. Both Manual and Automatic Reset types available; individual or repeatingly continuous operation. Automatic Elec. Mfg. Co., Mankato, Minnesota.

157. PROGRAM OR SIGNAL TIMERS—Used extensively for starting and stopping working hours, marking the beginning and ending of school class periods, sounding municipal time signals, and so on. Write for descriptive circular. Automatic Elec. Mfg. Co., Mankato, Minnesota.

158. ELECTRIC MOTOR REBUILDING MATERIALS CATALOG — 28 pages — gives complete descriptions, specifications and prices on all materials and replacement parts necessary for the electric motor rebuilding shop. Insulation & Wires, Inc., 2127 Pine St., St. Louis, Mo.

159. NEW COMPLETE FLUORESCENT CATALOG NO. 114—Lists in detail fixtures for every type of lighting application. New units abound in this book which is sure to be welcomed as the complete story on fluorescent by architects, contractors and jobbers alike. Day-Brite Lighting, Inc., St. Louis, Mo.

160. ELECTRICAL CONNECTORS — Complete up-to-date catalog of Handy Electrical Connectors and devices for repair, maintenance and new construction. Ask for publication Z-103. H. B. Sherman Mfg. Co., Battle Creek, Michigan.

161. RECTIFIED FLUORESCENT LAMPS AND LUMINAIRES—A recent booklet describing RF lighting especially designed for industrial lighting needs. Illumination layout data and illumination tables illustrate this booklet. Lamp Department, General Elec. Co., Nela Park, Cleveland, Ohio.

162. INDUSTRIAL TIMERS—New bulletin giving complete construction and operating data on synchronous motor-operated, manual reset Industrial Timers to time and control scores of manufacturing operations. Paragon Elec. Co., 409 S. Dearborn St., Chicago, Ill.

163. TIME CONTROL DEVICES — Engineering data on automatic reset timers and Time Delay Relays suitable to control hundreds of industrial operations. Numerous specific applications described. Paragon Elec Co., 409 S. Dearborn St., Chicago, Ill.

Please send to me without obligation, free booklets No. _____ described in the January 1942 issue of ELECTRICAL SOUTH.

Name _____

Company _____ Position _____

Number and Street _____

City _____ State _____

Tear out and mail to ELECTRICAL SOUTH, Grant Building, Atlanta, Georgia.

ADVERTISER'S INDEX

The Advertisers' Index is published as a convenience, and not as a part of the advertising contract. Every care will be taken to index correctly. No allowance will be made for errors or failure to insert.

A

Adam Electric Co., Frank 4
All-Steel Equip Co., Inc. ..... *
Aluminum Co. of America ..... *
American Coolair Corp. 69
American Steel & Wire Co. ..... *
Anaconda Wire & Cable Co. 8
Arrow-Hart & Hegeman Electric Co. ..... *
Asplundh Tree Expert Co. 61
Associated Business Papers, Inc. ..... *
Automatic Electric Mfg. Co. 67

B

Briegel Method Tool Co. 64
Bull Dog Electric Products Co. ..... *
Burndy Engineering Co., Inc. 70

C

Colt's Patent Fire Arms Mfg. Co. 59
Columbia Steel Co. ..... *
Couch Co., Inc., S. H. ..... *
Crescent Insulated Wire & Cable Co., Inc. 56

D

Day-Brite Lighting, Inc. 5
Dolph Co., John C. 67

E

Edison General Electric Appliance Co. 55
Electric Heater Co. 69
Electric Vacuum Cleaner Co. ..... *

F

Frigidaire Division ..... *

G

General Cable Co. 53
General Electric Co. (Insulating Materials) ..... *
General Electric Co. (Lamps) 10
General Electric Co. (Refrigerators) 2
General Electric Co. (Water Heaters) ..... *
General Electric Co. (Wiring Materials) ..... Back Cover
Glass Coffee Brewer Corp. 65
Globe Lighting Fixture Mfg. Co. 67
Graybar Electric Co. ..... *
Greenlee Tool Company 60

H

Hazard Insulated Wire Works 1
Hotel Lennox 68
Hotel Mayfair 70
Hubbard & Company 3
Hunter Fan & Ventilating Co., Inc. ..... Front Cover

I

Ideal Commutator Dresser Co. 68
Illinois Electric Porcelain Co. ..... *
Insulation & Wires, Inc. 69

J

Johns - Manville ..... *

K

Kelvinator Division ..... *

L

Landers, Frary & Clark 51
Linemen Protector Co. ..... *
Lloyd Products Co. 58

M

Mitchell Mfg. Co. ..... 33, 34, 35 and 36

N

National Electric Products Corp. 62
Norge Division 7

O

Okonite Company 1

P

Paragon Electric Co. 69
Premier Division ..... *

R

Revere Electric Mfg. Co. ..... *
Rogers, C. B. ..... *

S

Sangamo Electric Co. ..... *
Sherman Mfg. Co., H. B. ..... *
Signal Electric Mfg. Co. 66
Silex Company ..... *
Square D Company ..... Inside Back Cover

T

Treasury Dept. 63

U

United States Rubber Co. ..... *
United States Steel Co. ..... *

W

Ward Leonard Electric Co. 66
Westinghouse Elec. & Mfg. Co. (Full Line) ..... *
Westinghouse Elec. & Mfg. Co. (Ranges) ..... *
Westinghouse Elec. & Mfg. Co. (Refrigerators) ..... *
Westinghouse Elec. & Mfg. Co. (Safety Switches) Inside Front Cover
Westinghouse Elec. & Mfg. Co. (Water Heaters) ..... *
Wiegand Co., Edwin L. 69
Wiremold Company ..... *

Y

Youngstown Sheet & Tube Co. 6